Journal, June 30, 1926. Registered as a Newspaper.

Applied Science Dept.
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# GAS JOURNAL

## LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLXXIV. No. 3293.] LONDON, JUNE 30, 1926. [78TH YEAR. PRICE 1s.

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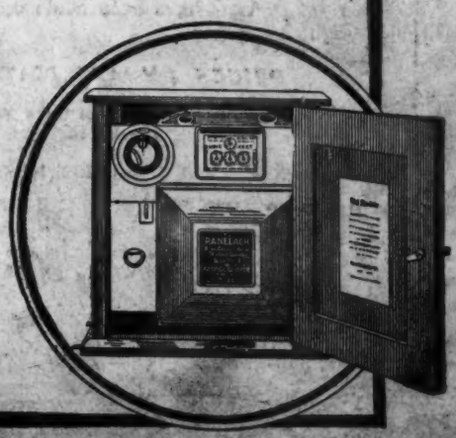

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# GAS JOURNAL

LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLXXIV. No. 3293.] LONDON, JUNE 30, 1926. [78TH YEAR. PRICE 1s.



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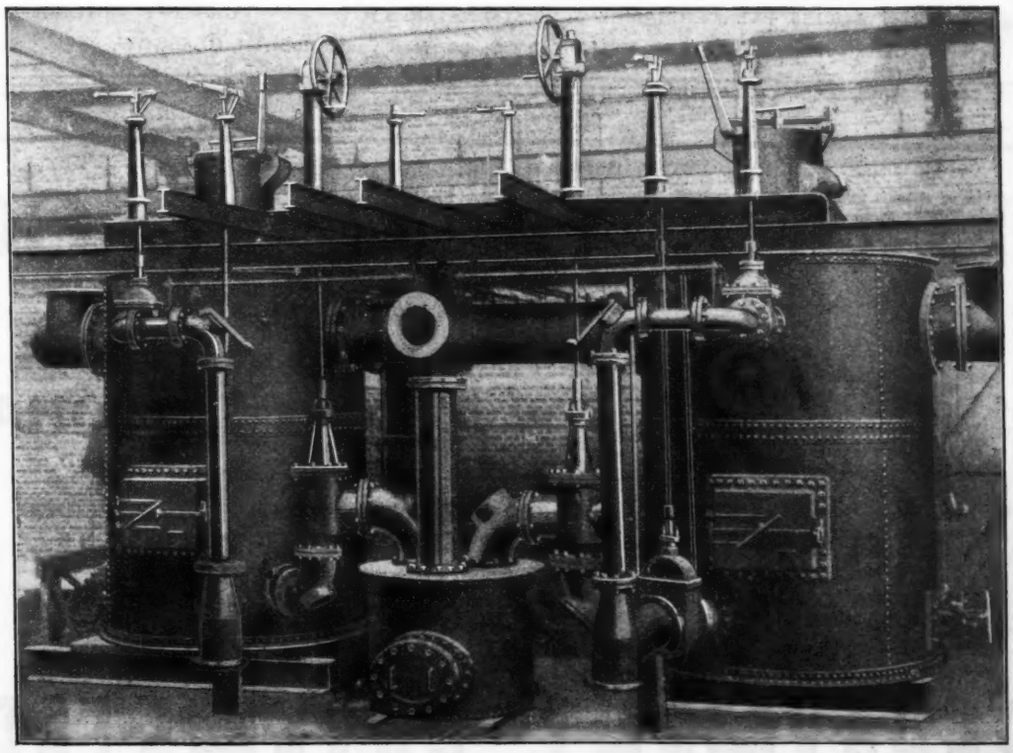

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*We shall be pleased, also, to consider any suggestion whatever to help you in the campaign we have indicated.*

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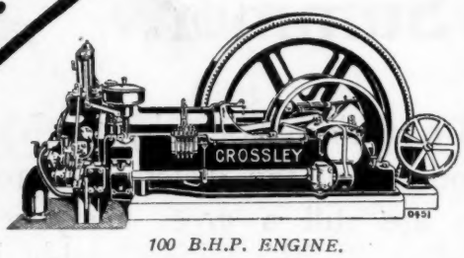


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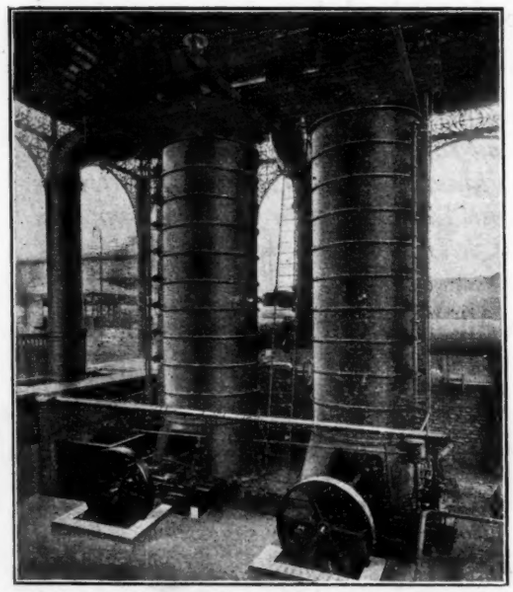
**"Standard" Centrifugal Washers**

**For Extraction of Ammonia, Toluol, Cyanide, Benzol, Naphthalene, etc., from Coal and Other Gases.**



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NOTE:—Repeat order received for two machines for this Station, and one in use at Saltley Station.

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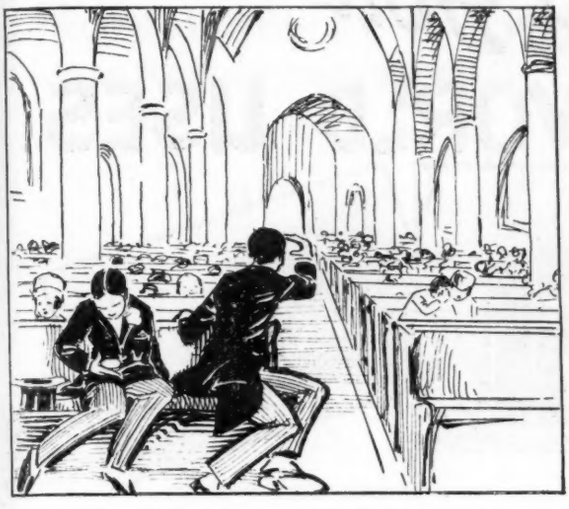
# Why she kept him "Waiting at the Church!"



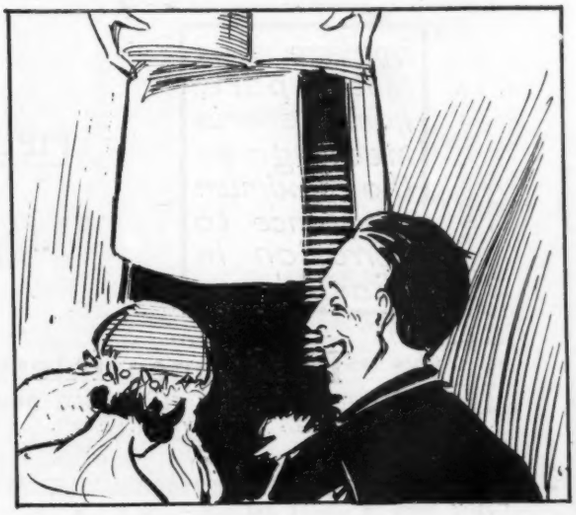
The Worst 20 Minutes He'd Ever Known!

"If she's not here soon, I'm off, old man!"

Meanwhile, she's ready to leave, but —

curiosity to see a last-minute present—

(a splendid WILSON "SUNBEAM" GAS FIRE)—



explains how she almost misses being Mrs.

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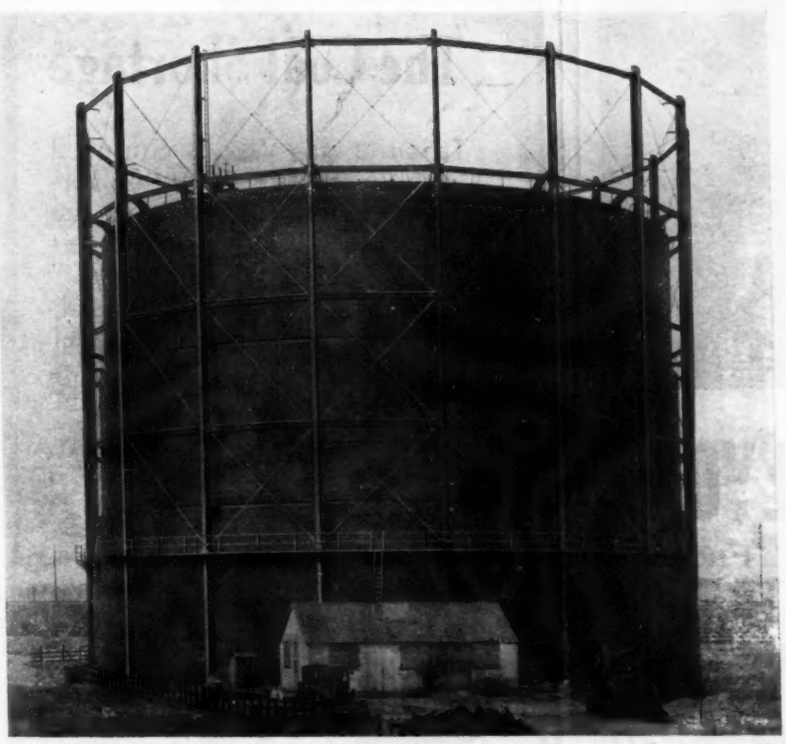

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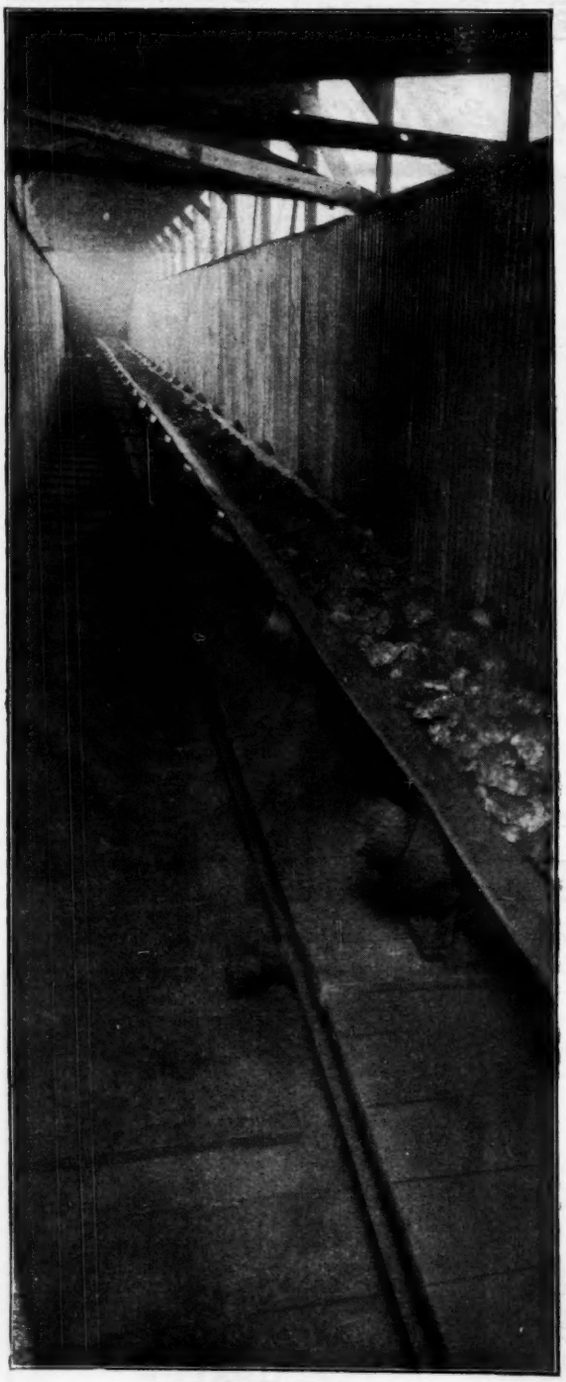

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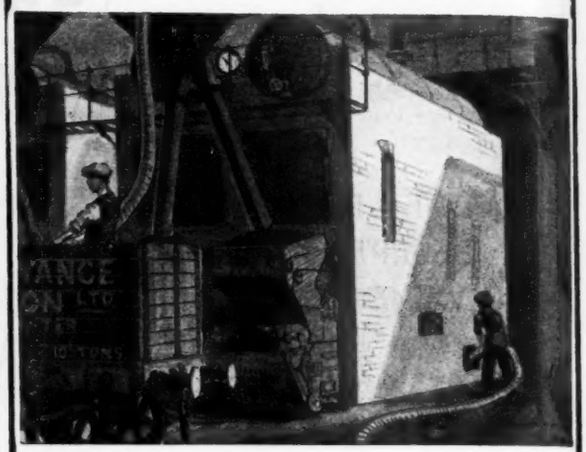

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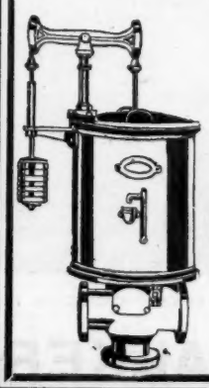

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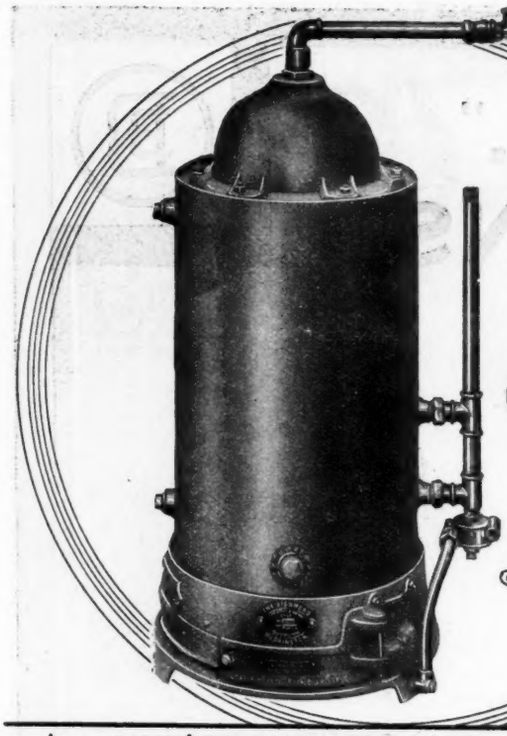

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A 'FITTING' REMINDER FOR SPRINGTIME---

THE cylinder of Richmond's "Hollar" Boiler has a cast-iron reservoir or dome, which is held in position like any ordinary cleaning cover plate, with standard bolts and nuts. This special design, in combination with the corrugated heating chamber, is an outstanding feature which makes for great popularity.

If hot water for cleaning only is required, you do not have to heat sufficient for a bath to get it. The special construction of the patent "Hollar" Boiler enables small quantities only to be heated, whilst sufficient hot water for one or more baths is always available at short notice when required.

Within ten minutes from the time of lighting the gas burner, a quantity of scalding hot water—at about 140° F.—may be drawn off at the tap for incidental requirements; within thirty minutes sufficient hot water may be obtained for all the general needs.

The "Hollar" Boiler can be kept thoroughly clean inside, and consequently its high working efficiency is always maintained. There is nothing to get out of order.

It is the easiest boiler to set to work and the quickest in use.

**Owing to the special design of the "Hollar" Boiler, the small size holding 12 gallons is capable of supplying the hot water for which a 20 to 25 gallon storage Cylinder is usually installed. The large size (25 gallons) will take care of the work usually obtained from an installation up to 40 gallons capacity.**

Fitted with positive-acting Thermostat. Send for Illustrated Lists.

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**and Grappenhall Works, Warrington.**

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*The Tar Plant People.*



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# GAS MAINS

with

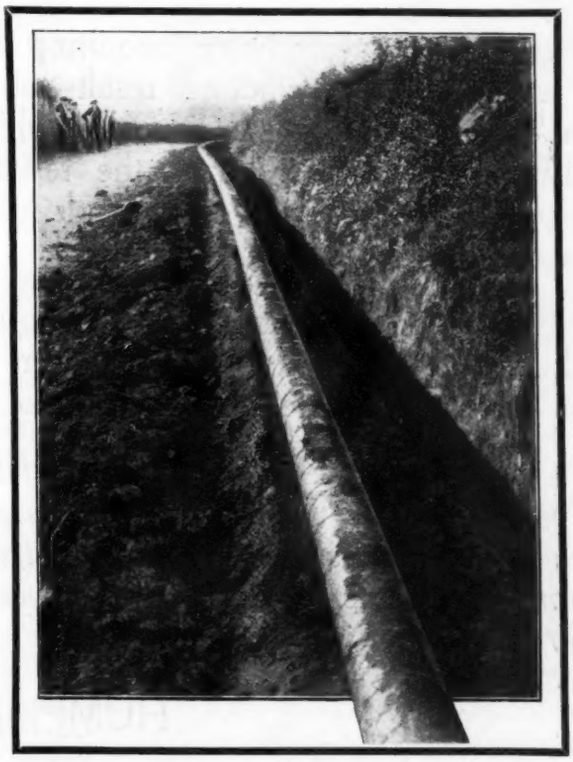
**Spigot and Faucet Joints,**

**Welded Joints,**

**etc.**

**BROMFORD TUBE Co. LTD.**

**BIRMINGHAM.**



**Gas Mains with Welded Joints, being laid at Hereford.**

# HUMPHREYS & GLASGOW LTD.

*Regarding*

## THE "BACK-RUN" WATER-GAS PROCESSES:

*TO WHOM IT MAY CONCERN—*

During the past year we have frequently announced in these pages that we had acquired from

The Young-Whitwell Gas Process Company, U.S.A.,

the EXCLUSIVE RIGHTS to the so-called BACK-RUN PROCESSES and all of their Improvements and Experience for ALL Countries except America.

*These Exclusive Rights and further Essential Developments are secured to us by Patents already issued to Messrs. Young, Glasgow, Whitwell and Steere, and by Patent Applications (two each) already made by Messrs. Stelfox and Chrisman.*

For two years before acquiring these Processes, we closely followed and analysed the conflicting results obtained in America, and we have spent the past year in *Developments* which efficiently adapt these principles to British Conditions—with the result that we have now successfully incorporated these improved methods in our current Standard Humphreys-Glasgow Water-Gas Plant.

We are also now prepared to apply these improved Processes in combination with other recent major improvements to *existing* Water-Gas Plant, and invite investigation to that end.

*Except in America, no one but ourselves is authorised to instal and operate these Back-Run Processes, and the pressing cause for this renewed publicity is lest Gas Administrators assume—as they might well assume—that other "Back-Run" advertisers have obtained authority from us for such advertisements.*

HUMPHREYS & GLASGOW, LTD.,
*By A. G. Glasgow.*

38, Victoria Street, London, S.W.

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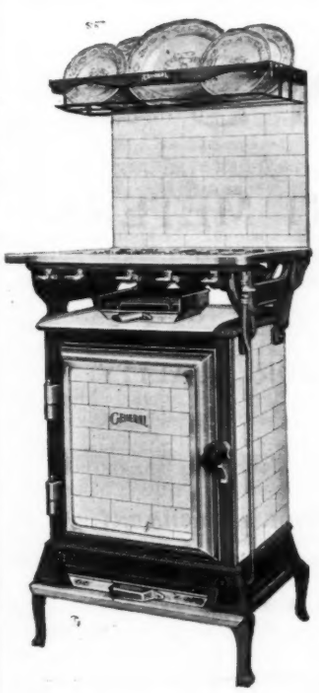

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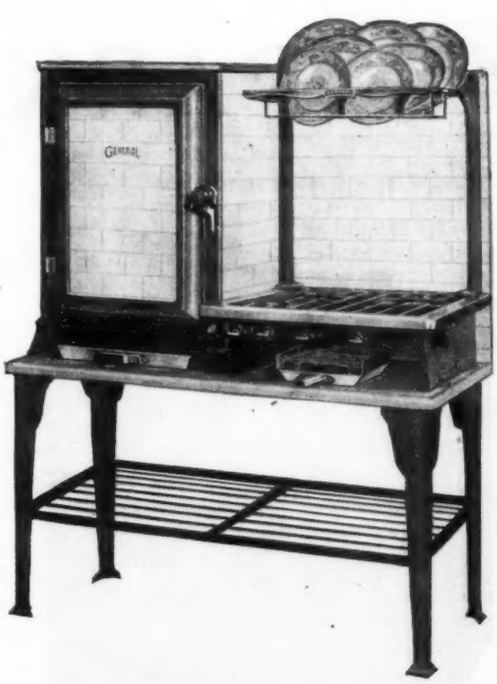

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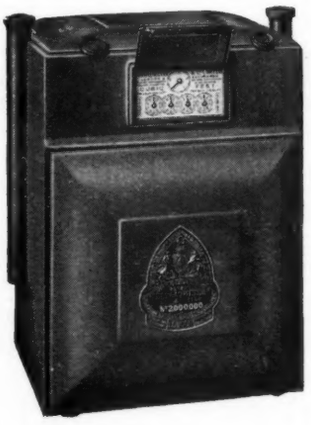

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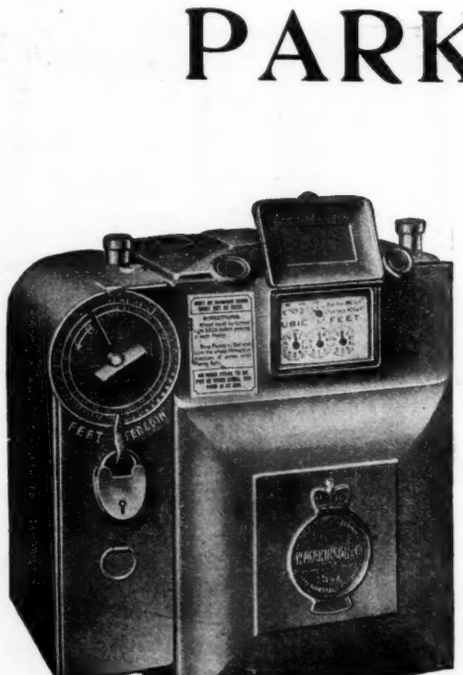

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VOL. CLXXIV., No. 3293.] WEDNESDAY, JUNE 30, 1926. [78TH YEAR.


## EDITORIAL NOTES.

### A Twenty-First Anniversary.

It seems almost impossible, but relentless time gives the confirmation, that twenty-one years have sped by since the founding of the Society of British Gas Industries. The annual meeting and dinner of the Society last Wednesday were in the nature of a celebration of the "coming of age" of the organization, and naturally there was a good deal of looking-back during the business proceedings and the evening function, with well-deserved and hearty congratulation throughout. At the same time, there was much sound counsel in the Presidential Address of the Rt. Hon. Sir Alfred Mond, Bart., M.P. It urged us to look-forward, and to adopt a policy which will open-up the ways to larger development and opportunity in service, which is essential in any industry constantly exposed to increasing competition, unless the responsible men desire to dam the flow of its prosperity.

This being an exceptional year in the history of the Society, we are privileged to take a backward glance over it. It shows that no wrong was done by the "JOURNAL" in publishing the article which suggested the formation of such a body; the same history proves that those who founded the Society (with Mr. Charles Clare as an enthusiastic prime mover)—despite all the difficulties encountered, and the little encouragement received in the beginning—did the right thing. The visions of ill, formed in the imaginations of those who judged things by the traditions and practices of a former day, and who thought that organization in the industry was limited by a sort of prescriptive right, have had their refutation in actual facts. The Society started in a small way, with somewhat faltering steps. It was an innovation which had not previously been contemplated. It was all new; and there was nothing to guide. There were some who positively feared to do what was proper and right in strengthening their own side of the industry, in order to be better able to assist in all progressive work, lest they gave offence to others. But that fear was short-lived. The new organization gained courage, strength, alertness, and power as it went along; and to-day (as it has long been) it is an embodiment representative, effective, virile, and indispensable to the manufacturers of gas plant and gas-utilizing appliances, and to the gas industry generally. It has been the means of creating a new atmosphere and a new spirit in the industry; and an equality is now recognized, which, though it actually existed before, was not openly admitted. It would have been strange, while the gas-supply side of the industry was strongly organized, if the other important part of the industry had remained as floating units without any organization, voice, or ability to do good co-operative work in the industry, the interests of which are of as great concern to the members of the Society as to those directly engaged in the supply of gas. Had the Society not been formed twenty-one years ago, what would the industry have missed?

The proceedings of the Society have been dignified, and have commended themselves to all men. The internal work has been of inestimable worth. The co-operative influence of the Society has enabled matters to be carried to a length in many directions which would otherwise have been impossible. There has been no movement, during the past twenty-one years, for the benefit of the industry as a whole in which, in some way or other, the Society have not taken their part. Year after year the members have had Presidents of position and renown, which fact has given to the organization a roll of Past-Presidents such as few, if any other, organizations can claim. Energetic and earnest Chairmen and members of the Council have done much to advance and bond the work of the Society in the interests of the represented firms and of the gas industry generally. One thing that has struck us forcibly is—the Society has never been used for the business advancement of any individual firm. While the members rightfully claimed a voice in the activities of the industry, the common weal of the industry as a whole has always stood at the forefront of its operations. It was an honour to be the Chairman of the Council in this red-letter year in the history of the organization; and it was with unfeigned pleasure that Mr. B. B. Waller presented a report, moderate in its references to the past, but with gratification manifest in every line, which the Council had prepared, and the adoption of which was followed by a tangible recognition of the loyal and scrupulous service over a long course of years of the Secretary, Mr. Arthur L. Griffith. We can heartily endorse from intimate knowledge the words of the report: "The aims and objects "for which the Society was established have, it is sug- "gested, been attained, the scope of its utility has been "enlarged, and a wide field of useful work for the indus- "try has been achieved by collective effort, which had "it been left to individuals might not have been accom- "plished." We should have preferred that the word "claimed" had been used instead of "suggested," for such facts as we see in the history are realities which cannot be disputed. We feel sure that the aspiration of the Council that "the success which has attended its [the Society's] efforts over that period will be maintained in the future" is one which will be fulfilled. There can be no going back. The Society is too well established for that; and motives and ambitions have grown stronger with the passing years. The members, too, know full well that good as the outlook is for the gas industry, all the conditions point to the fact that defence and advance will need the most strenuous and consolidated effort from all concerned in its future. It is not going to be a walk-over; and what is more, if the address of Sir Alfred Mond is studied, together with the legislative programme of the National Gas Council, it will be seen that there are somewhat revolutionary possibilities before the industry, in which the manufacturers of gas plant and of the accessories to gas supply and use will find new openings for their skill and enterprise. Some of the men who saw in the suggestion made in the "JOURNAL" twenty-two years ago something worth pursuing, and who helped Mr. Clare in the work of materializing the idea, have passed to their rest. May we specially mention John Glover and Thomas Marsh? They and others assisted in the foundation work; and, in doing so, they helped in an advance of a very effective order in the organization of the gas industry. The edifice which has grown upon foundations well and truly laid is a memorial to their wisdom.

We congratulate the Society upon their majority, and upon the work accomplished during the twenty-one years. And for the future our wishes are of the brightest and sincerest.

The valuable address delivered by Sir Alfred Mond last Wednesday will receive comment next week.

## Signs of Collapse.

IF asked whether there are any signs of the coal strike coming to an early end, we should say there were, and should point first to the suggestion of Mr. Vernon Hartshorn for a round-table conference, which was made in the House the other night, but which the Miners' Federation have repudiated. We should next refer to the suggestion of the hysterical Mr. Cook that there should be what he calls an "armistice," and that the men should return to work on the April terms while a new agreement was being hammered out. That is a matter which has been the occupation of many months, and has cost the country many millions of pounds, all through the incompetence and stupid obstinacy of the leaders of the Miners' Federation, who refused to square their policy with the facts of the position. It has been pointed out that Mr. Cook's suggestion is based upon a desire rather than an expectation; and that is about the truth of the matter. Then we learn from the coal-fields that more men have returned to work, and that many more thousands would do so were they not afraid of intimidation. Funds have run-out in some quarters, and are very low in others, and the support from abroad has been fast on the ebb. The workers in other countries will not indefinitely continue to support idleness in another country—not even for the sake of, in the circumstances, a bad cause. Further, the leaders in the Miners' Federation now realize that the Government mean business in dealing with the question of hours; and they see that the ground will be, to a greater extent than before, cut from under their feet. They know, as all the world knows, that a large proportion of the rank-and-file appreciate that the vain boasting of certain of their extremist leaders are hollow, and they are abandoning hope of securing from them further help in the senseless fight against economic conditions. It is beyond the power of anyone to modify the latter; but it is within the men's power so to operate as to relieve their incidence. It is to meet those conditions that it is necessary to get a greater production per man-shift.

There is very good expectation by those in close touch with the conditions in the coal-fields that, as soon as the Bill for an eight-hour day is well on its way, the men who have resumed work will be supplemented daily—by the offer of the April rates of pay or the best terms permissible for an eight-hour day—until the collieries have as many men employed as the demands for coal necessitate. Thousands of miners will find that their leaders have brought them into a position from which there will be no escape—a position of long unemployment, unless work can be found elsewhere. The demand for coal is not likely to be extensive (other than for replenishing stocks, which will be a gradual proceeding), for some time to come, seeing that many of our best coal contracts have already been taken from us, and the work of producing the coal given to the miners of other countries, who the so-called "leaders" of the British miners hoped would prevent coal coming to this country, while making no provision against the passing to others, while the strike lasted, of our overseas custom. This neglect was suicidal; but perhaps it would have been equally as foolish to endeavour to stop the transfer of custom as to think the miners of other countries could stop the machinery of the world landing coal in this country. Only last week the Miners' International Federation had a conference in London with the Miners' Federation, at which the promise was again made to try to put an end to the importation of coal to this country, and thus help to strangle it. The patriotism is not conspicuous; the promise will have as much effect as it has previously had. The fact is, coal is coming to our shores in increasing quantity. We rather fancy that this strike will be known in the future as one for the production of unemployment among the miners. Through the strike, too, trade and employment in the country are going from bad to worse; and the period will be long before we again arrive at what may be termed the new "normal circumstances." During all this time, the demand for coal will be on a lower scale than even during the depressed period preceding the strike.

Meanwhile, the Mines Re-Organization Bill (which only deals with matters which can receive early attention, leaving for the time being the other subjects suggested by the Coal Commission which require deeper and broader consideration before legislative measures can be framed) was introduced to the House last week, and obtained its second reading. The Hours Bill is being taken in hand this week; and the debates have already been of a rather exciting order. Regarding the Re-Organization Bill, it provides for promoting the re-organization of the industry by the amalgamation and absorption of mines; the extension of facilities for working minerals and the removal of restrictions; a welfare fund by a levy on royalties; power to regulate the recruitment of mine workers; limitation of further assessments and claims in respect of coal mines excess payments and coal levy; and empowers coal mining companies to establish profit-sharing schemes. The only operative clause in the Hours Bill reads as follows: "During the continuance of this Act, "section 3 of the Coal Mines Regulation Act, 1908, shall "have effect as if the words 'on not more than sixty "days in any calendar year' and sub-section (2) thereof "were omitted therefrom." What the provision will permit is the extension of the statutory seven-hour day to eight hours, and will operate for a period of five years from the passing of the Act.

## Sliding-Scale Minimum Dividend.

THE report (published last week) of the proceedings before the House of Commons Committee on the Gas Light and Coke Company's Bill—the capital feature of which is the proposal to incorporate in the sliding-scale a minimum dividend of 5 p.ct. on the ordinary capital—will have been read with universal satisfaction by the administrators of companies operating under the sliding-scale. This satisfaction will be felt not only through the success of the Company in proving the righteousness of their case for a minimum dividend, but also on account of the weakness of the opposition case against this act of justice being rendered by Parliament. We cannot sympathize in the slightest degree with an opposition which makes an attempt to destroy the hard justifying facts for a revision of the old-time legislative enactment passed in circumstances which, during the past twelve years, have completely changed. Of course, the Gas Light and Coke Company are not the originators of a minimum dividend on ordinary gas capital, seeing that the basic dividend of the South Metropolitan Company inaugurated a condition of things which has assisted in rectifying unfairness to the proprietors and in stabilizing the capital of that Company, and of other companies who have since adopted the basic system. Furthermore, in the London Electricity Acts of last session, the principle of a basic dividend with the sliding-scale was applied to fourteen electricity supply companies. What, however, the Gas Light and Coke Company are doing is, without making any radical change in the sliding-scale, to pioneer the introduction to it of a line below which the dividend will not fall, providing profits will permit payment of such a rate—that is to say, the minimum dividend is not in any sense a guaranteed one, and it will not be cumulative. But though the price of gas rises to a figure which would, in present circumstances, bring the dividend below 5 p.ct., if the profits (after meeting the statutory obligation in respect of the redemption fund) will permit of the payment of 5 p.ct. there will, assuming the measure passes, be no dropping below it.

It was the war which revealed, with uncomfortable emphasis, that the sliding-scale was incapable, under abnormal conditions, of protecting the capital invested in gas company undertakings; and the higher costs of materials and labour, and the unrest and organization developments in the labour world, all point to the fact that the conditions which prior to 1914 ruled in the operation of the sliding-scale are never likely to be restored. And changes are still growing which necessitate a revision of statutory protection for gas capital under the sliding-scale. As was pointed out in evidence by Mr. D. Milne Watson, the Governor of the Company (who was strongly supported by Sir William Plender, Mr. Lawrence Currie, the well-known banker, and Mr. C. H. Whittington, whose name stands high in the stockbroking world), in every department of the operations of a gas undertaking

there is to-day competition of an intense order, which did not exist at the time the sliding-scale was initiated. Moreover, great as the competition of the electricity industry has been in the past, the Government have assisted, by their electricity scheme, further to place the gas industry under a cloud so far as the investing public are concerned. The minimum dividend is, therefore, desirable in order to restore gas capital to its old position of acceptability on the part of investors. Unless a feeling of confidence is again produced by giving better assurance as to dividend, the public will not again supply capital to the industry at the prices that formerly obtained, which would mean the employment of dearer capital—a condition of things unfavourable to the great public who are the consumers of the industry's primary product. We are, of course, assuming that the Bill will pass unscathed through the House of Lords. If it does that (as we feel confident it will), then, so far as the main capital of the Gas Light Company is concerned, there will at once be established among investors a feeling of greater security than now exists. What the Government have done, or are doing, for the electricity industry, will suffice to provide it on reasonable terms with any capital it requires. In the case of the gas industry, it is foreseen that there will be considerable developments in the utilization of gas, and a large amount of capital will, in consequence, be needed in the future; and for this and other reasons, gas undertakings ought not to be in any way in an inferior position to electricity concerns in respect of capital-raising power.

There are two points in the case placed before the Committee upon which a little comment may be passed. One is that the introduction of a minimum dividend into the sliding-scale will remove some of the incentive to good management with which it was the intention of the sliding-scale, when originally devised, to invest gas companies. There need be no fear regarding the removal of the incentive. There will be, in the first instance, the natural inclination to reduce, by good management, the price of gas as low as possible in order that the dividends may be raised, and maintained, above the 5 p.ct. level. The higher they can be taken under the operation of the sliding-scale, the lower will be the price of gas to the consumers, and the better the value of the stocks in the eyes of investors. Moreover, the lowest possible price is a paramount necessity in these days when electricity is striving in every city and town to wrest business from the gas industry. Competition alone will suffice to ensure the continuation of good management which has characterized the industry in major part for a great number of years; and constant effort is made to conform administrative policy to the changing circumstances. The other point (made by one of the opposing Counsel) is that, while there could be no objection to applying the minimum dividend to new capital, it would be unfair to apply it to the existing capital. The submission suggests a very narrow examination of the position. It takes no account of the fact that the times and economic conditions have altered, and that investors, like other people, have enlarged their outlook. Again, it does not give consideration to the fact that the old capital has suffered very severely. In short, the submission amounts to this, that the lessons of that suffering might permit of the minimum dividend protection being allowed to the buyers of new capital, but that those whose capital has been exposed to, and has had to bear the vicissitudes of the past, are still to be subject to a defect which has developed through no fault of theirs. We cannot compliment the opposition on having shown either logic or justice in the presentation of their case against a proposal which is so transparently fair, and, furthermore, a politic act.

After the examination of the position by the House of Commons Committee, and their complete verdict in favour of the proposal, we feel confident that it will succeed in passing unaffected through the remaining stages of procedure. If this is so, the result will be of great value to the considerable part of the gas industry at present operating under the sliding-scale. We foresee the time when the minimum dividend will be universally an integral part of a system of regulating dividends to charges—a system which worked well prior to 1914, but has since seriously collapsed, to the detriment of the capital of sliding-scale undertakings, and of the interests of gas consumers. To re-establish a sound position for that capital—circumstances having so materially changed—is undeniably the duty of our Legislature.

## Combustion of Carbonic Oxide.

IN as plain language as his subject would allow him to command, Prof. W. A. Bone, D.Sc., F.R.S., of the Imperial College of Science, last Thursday delivered a lecture, in the Lecture Room at the Horseferry Road Offices of the Gas Light and Coke Company, on "The Combustion of Carbonic Oxide." The lecture was directed to the virtues of this gas, and to the phenomena of its combustion. Carbonic oxide has always had a great fascination for Prof. Bone; and no one appreciates more than he its high utilitarian qualities, which, however, we cannot enjoy without at the same time accepting its vicious attributes. Fortunately, however, good workmanship can put under control its bad side, and permit us to have the advantages of its effective service.

An explanation should be given as to the reason for this lecture. When Prof. Bone left the Leeds University for the Imperial College of Science, where his first work was to establish the new fuel research laboratories (which are second to none in the kingdom), he decided to make the combustion of carbonic oxide one of their chief concerns. For some years this has been engaging his attention; and research has been going on almost continuously into the many phases of the important subject, with the result that old views and postulations regarding it have been completely deposed, and actual knowledge has taken its place. The work has been facilitated and accelerated by the generous founding by the Gas Light and Coke Company, in connection with the Department of Chemical Technology, of a Gas Research Fellowship, and a second fellowship has also been established by Radiation Limited. The first holder of the Gas Light Company's Research Fellowship is Mr. F. R. Weston, B.Sc., A.R.C.S., and to him were entrusted certain aspects of this particular work. It may be said that, through his skilful and painstaking labours, working under the supervision and direction of Prof. Bone, there have been new and valuable revelations, which, adding to our scientific knowledge, supply (as will be seen from the lecture) full justification for the founding of the Fellowship.

In the lecture, Prof. Bone first compared the combustion of carbonic oxide and hydrogen; and in this connection he pointed to some practical considerations in regard to the industrial uses of certain gaseous fuels which have hitherto never been properly explained. Steel makers have a great partiality for a higher proportion of carbonic oxide than hydrogen in the gas they use for their operations. They prefer what they call a good "soaking" heat in their furnaces rather than the "cutting" heat of a producer gas. In order to realize that "soaking" heat, they have a preference for a gas containing (say) 30 p.ct. of carbonic oxide and 12 p.ct. of hydrogen; in producer gas, which gives the "cutting" heat, the proportions are reversed. As Prof. Bone points out, water gas, as generated from good gas coke, contains (say) 42 p.ct. of carbonic oxide and 48 p.ct. of hydrogen; but the appearance of the flame and its behaviour in the furnace are much more like that of hydrogen than of carbonic oxide. It is an excellent fuel for steel-welding. Thus in the experience of practical men using gaseous fuels daily in industrial operations, it seems as though, when the two gases are burned together, hydrogen is (so to speak) the stronger partner, having the power of imposing its characteristic mode of combustion upon the carbonic oxide. It is upon this aspect of the matter that it has been sought to throw light by scientific investigation. So we are taken in the lecture from Prof. H. B. Dixon's discoveries and theories in the 80's and 90's, and from the general view then obtaining—that the presence of steam is in all instances essential to the combustion of carbonic oxide—to the researches at the Imperial College of Science, which have knocked on the head the theories and postulations which previously obtained.

In 1923 it was shown by the investigations that the

presence or otherwise of water vapour has very little influence upon the rate of pressure development in the explosion of a theoretical CO-air mixture at an initial pressure of 40 atmospheres—in other words, carbonic oxide does combine directly with oxygen at high pressures without the intervention of steam. Then came in Mr. Weston as the first Gas Light Research Fellow; and his work has been directed to an investigation along these lines: Spectrographic investigations; experimental study of how the ignitibility of a mixture of carbonic oxide and oxygen in combining proportions is affected by progressively drying it; and the proof that a rigidly dried mixture of carbonic oxide and oxygen can be exploded at atmospheric pressure by a sufficiently powerful condenser discharge. Following this came the work of Mr. R. P. Fraser (the holder of the Radiation Gas Research Fellowship) upon the influence of pressure on the ignitibility of a rigidly dried carbonic oxide and oxygen mixture. Towards the close of his lecture Prof. Bone summed up the new facts which have emerged from the investigations; and for their full import readers are directed to the reproduction, in later columns, of the lecture. But, briefly stated, the researches have proved that the presence of steam is not essential to ignition and explosion of carbonic oxide and oxygen mixtures, but that the two gases can and do combine directly without its intervention. Thus the old theories are completely dislodged. Then the spectrographic evidence advanced by Prof. Bone shows that, when undried carbonic oxide is burned at a jet in undried air (or oxygen) at ordinary pressures, both the direct and the indirect oxidation go on simultaneously and independently; also that it is the radiations excited by the direct CO-oxygen interactions in the flame which give rise to the continuous and banded parts of its spectrum, while the "steam-lines" are due to radiations excited by the $CO\text{-}OH_2$ interactions. An increasingly high pressure undoubtedly favours the direct oxidation; so that at high initial pressures it predominates to the exclusion of the indirect. On the other hand, the presence of hydrogen in the burning mixture certainly favours the indirect oxidation, so that in a water-gas flame at ordinary pressure the indirect predominates to the practical exclusion of the direct, and the character of the radiation emitted is modified accordingly. This is a most important consideration in its bearing upon the practical uses of water gas, and other mixtures of carbonic oxide and hydrogen. Further, it may now be said that the characteristic radiation emitted by a flame in which the combustible gas is carbonic oxide only is rapidly eliminated when hydrogen is added to the burning gas. Although (as Prof. Bone says) this is a point more of theoretical than of immediate practical interest, the results of the investigation undoubtedly also show that, while steam plays no essential rôle chemically in the combustion of carbonic oxide, the presence of a minute amount of it does in some way or other—presumably physically—help to overcome the extreme reluctance of the dry gas to burn.

We must leave here the account of this instructive work and the conclusions from it, in the hope that sufficient has been said to induce a widespread study of the lecture itself, which embraces much more than we are able to touch upon here. But we desire, in conclusion, to draw attention to the Fellowships which have been established in connection with the work of Prof. Bone's Department at the Imperial College of Science. That of the Gas Light and Coke Company was established, three years ago, for encouraging experimental research in relation to carbonization, gaseous fuels, and combustion, and in order to attract and train in research young men of exceptional ability and promise for the service of the gas industry. The similar Gas Research Fellowship established a year ago by Radiation Limited causes one to become vacant each year. Mr. Weston was appointed to the Gas Light and Coke Company's Fellowship three years ago; and his tenure of it will expire on Sept. 30. He has been, with conspicuous success, prosecuting research upon the subject with which we have been dealing; and, in addition to Prof. Bone's lecture, the results of his experiments have been published in three papers in the "Proceedings of the Royal Society," 1925 and 1926. It is to be hoped that the advantages offered by such fellowships will attract young men of promise to the post-graduate course in chemical technology at the Imperial College—which includes fuel technology (with refractory materials), chemical engineering, and electrothermics—on the results of which the fellowships are subsequently awarded, so that the gas industry may benefit accordingly. The conditions of the Gas Light Fellowship (which is soon to become vacant) are referred to in a later column.

## Small Works and Tar Dehydration.

THERE are many small works in the country which, through their local circumstances, would undoubtedly find it much more profitable to dehydrate their tar *in situ*, and dispose of it direct for road purposes, than to have to bear the carriage of the product to the works of tar distillers, and then for the users to have included in the cost the redelivery locally of the prepared material. The address which Mr. Lawrence Farquhar, of Peebles, delivered to the Waverley Association of Gas Managers last Friday was devoted mainly to the consideration of this subject; and we think his experience is of such a notable character, financially and practically, that it will have a considerable influence with those in charge of small works who have not yet fully probed the relative advantages, and so are still doubtful as to the merits of engaging in dehydration. There is no great difficulty about it; and the responsibility of the additional operation is not of a character which anyone need shirk, if the financial results can be proved to be of a favourable character. To obtain that proof, Mr. Farquhar supplies the necessary factors from his experience.

It will be remembered that, in the "JOURNAL" for the 16th inst., we gave for the year 1925-26 the prices received for tar per 100 gallons f.o.r. distillers' works, under the National Gas Council (Scottish Section) tar scheme. The average price was 23s. 10d. per 100 gallons. From Peebles to the works of the tar distillers, the cost of the carriage of tar is 6s. 3d. per ton; and Mr. Farquhar has roundly 250 tons for disposal which is completely absorbed in the burgh and county, with the exception of a small amount needed for the tarring of deep-sea fish nets. If the local consumers of tar had to purchase from the distillers' works, they would have to pay a price which includes the cost of the return carriage on the tar; but this is obviated by the adoption of dehydration on the gas-works. The form of plant Mr. Farquhar has adopted is the Clayton cascade system, with a capacity of 50 gallons per hour. As he says, there are several plants on the market which are simple, safe, and reliable; and to-day, with extensive experience, it is an easy matter to secure actual working costs and efficiency of the different plants before deciding upon the type to be adopted. The address, it will be found, includes descriptive particulars of the plant at Peebles, which works with a fuel consumption of 100 lbs. of coke breeze per ton of tar dehydrated. Wages and fuel only represent 2s. 3d. per 100 gallons, or 0·27d. per gallon, dehydrated. Interest and depreciation (on a five years' basis), less income from crude benzole, brings the total cost of dehydration to 62·92d. per 100 gallons; and Mr. Farquhar is in the fortunate position of being able to state that the increased revenue from tar after dehydration is, in his case, 19s. 10½d. per 100 gallons. Therefore, from the financial point of view, the plant has, in the circumstances of Peebles, abundantly justified itself.

There is no doubt that Mr. Farquhar is very proud of the condition of the tar bound and surfaced roads in Peeblesshire. He describes them as being of the highest standard; and, in view of this experience, he is confident that it is only vigorous boosting, and not inherent merit, which has obtained for bitumen a degree of success in displacing tar. There is a further confidence on his part that by good work the competition of imported bitumen can be defeated. Regarding, too, the allegations of fish destruction through the tarring of roads, he cannot find any trace of this in his county. Though the greater part of the roads is tarred, his conviction is that properly prepared and applied tar is free from blame for river pollution; and whatever injury is occasioned to fish through pollution must be looked for in other directions. It will be

noticed that Mr. Farquhar is of opinion that the Road Board specifications for tar are somewhat too exacting; but, in this connection, it will also be observed that his own tar complies almost item for item with the specification, although receding somewhat more from the No. 2 tar than the No. 1. In this connection, it will be remembered, the central authorities are engaged in discussing the requirements of road authorities, with the view to securing a new specification. Until this is done, the old specifications retain the field, though not universally obeyed in practice. The address, although not of great length, is a distinctly interesting and useful one.

## Sulphate of Ammonia and Tar in 1925.

THE annual reports of the Chief Inspectors under the Alkali, &c., Works Regulation Act have been considerably condensed on this occasion. This is probably due to the call for economy in the Government Departments. Whether or not this is the reason, it is a pity that technical and commercial information should be abbreviated to a large extent when, contributing to the general progress, it is frequently of inestimable worth. For example, in this report the general comments on the work of the year have been curtailed to the narrowest possible dimensions, as have the statistical data

In the return which Dr. T. Lewis Bailey makes for England and Wales of the ammonia products manufactured in 1925, expressed as sulphate 25¾ p.ct. $NH_3$, the figures for gas-works are given; but all other sources of output—coke-ovens, iron-works, producer gas plants, synthetic production, &c.—are aggregated, so that one cannot trace, by comparison with previous years, how matters have been going with them separately. Now that the synthetic product has come into the market, the individual information would be far more interesting and useful than the collective. There was a shrinkage in the total production of 11,568 tons compared with 1924, in which year it was 362,180 tons, as against 350,612 tons in 1925. Of the difference of 11,568 tons, gas-works were responsible for 2216 tons, and other plants for 9352 tons. Thus it would be instructive to know which of the sources of supply contributed to the reduction shown. Probably the position of the market for coke, and its increased use for making water gas (so reducing the make of coal gas), together with the lower price of sulphate through the heavy competition that is proceeding in the world's fertilizer markets (particularly since the synthetic product entered the fray) accounts for the diminished output from gas-works. It is pointed out by Dr. Bailey that of the total quantity of ammonia products, the equivalent of 31,581 tons was manufactured as concentrated ammoniacal liquor; the balance of 319,031 tons consisted of other ammonia products—sulphate, chloride, nitrate, &c. In Mr. Young's report for Scotland, it is stated that the yield of ammonia from gas-works was slightly greater, but from all other sources less. Here the figures are set out for all the sources, but there is no synthetic production in Scotland. There was, however, a large falling-off—the total production being 78,906 tons, compared with 91,228 tons in 1924, or less by 12,322 tons. Adding this to the decline for England and Wales, we have a total diminution in output of 23,890 tons. In Mr. Young's report, it is remarked that the ammonia is expressed as "pure sulphate." He also states that, of the Scottish total, 1258 tons were obtained as concentrated liquor ammonia, and 512 tons as ammonium chloride. But taking the total figures as representing sulphate of ammonia, we have for England, Wales, and Scotland, an aggregate make for 1925 of 429,518 tons, as compared with 453,408 tons for 1924—showing the reduction of 23,890 tons. Of Scotland's 78,906 tons, 22,134 tons were produced by gas-works; the shale works representing the major part of the balance with 44,400 tons.

There is little of a general nature to notice. In the reports of Dr. Bailey and Mr. Young, we see that quality of sulphate of ammonia continues to be studied, and that the making of a high-strength neutral material has now become almost general. What is wanted now is greater attention to the question of a more universal production of larger crystals. A companion line of research is that of effluent disposal "which continues to obtrude itself in fresh directions." Largely through the instrumentality of Dr. Bailey, the National Gas Council have taken the matter in hand, and have referred it to the Council of the Institution of Gas Engineers, who have appointed a Special Committee to carry out an investigation.

Recognition is given by Dr. Bailey to the good behaviour of tar-works; and Mr. Young states that, while tar stills and dehydrators increase in number and variety, efficiency has been much improved, even in the smaller and simpler stills, although there yet remain some which deliver prepared tar incompletely freed from naphtha and water. This is a matter to which there must be closer attention, as there is no need for such a condition. Imperfections of the kind give tar a bad name with road authorities, who do not hesitate to talk of their experiences. From gas and coke-oven works in England and Wales, 1,490,521 tons of tar were distilled, and from other works 10,145 tons—together 1,500,666 tons. The yield of pitch from gas and coke-oven works was 461,241 tons, and from other works 4312 tons—together 465,553 tons. The tar distilled in Scotland amounted to 188,827 tons; and the production of pitch was 54,265 tons. Thus the aggregate quantity of tar distilled in England, Wales, and Scotland in 1925 was 1,689,493 tons.

Speaking generally of the reports, they indicate technical progress in all directions; and with that advance there is a closer observance of operating rules and conditions which obviate nuisance. But lapses occasionally occur. For instance, while, in connection with sulphate of ammonia plants, Dr. Bailey says "the instances of inefficient supervision have been few," he adds that it has been necessary at "several" works to press for reconstruction of the purifier floors. That word "several" must not have ground for reappearance. As Dr. Bailey says, there is always the possibility of the cracking of such floors after prolonged use; and the trouble is that sulphuretted hydrogen, passing through the cracks in the floors, may wander considerable distances before making itself manifest. The manifestation is not of a pleasant character.

### Smoke Abatement Bill.

In an excellent speech, the Minister of Health (Mr. Neville Chamberlain) introduced to the House of Commons last week, for second reading, the Smoke Abatement Bill, which has already passed through the House of Lords. From the general tenor of the debate on the occasion, it seems evident that the time will come when the Government will have to set aside the timidity which is constantly being shown in connection with doing something to assist the work of minimizing the emissions of the domestic chimney. There is no difference of opinion in Government circles, Mr. Chamberlain says, regarding the desirability of trying to help in the beneficent work of bringing about the purification of the atmosphere; and he submits that, by the present Bill, they are doing something to strengthen the law and its administration. In his view, upon administration there will have to be great dependence in respect of securing improvement from atmospheric pollution. He dealt with the Bill clause by clause. Referring to clause 2, he said that private dwellings are expressly exempt; and yet he admits that they are the greatest sinners in the production of smoke. However, while the clause will not apply to existing dwellings, it is suggested that local authorities shall be given power to require that new dwellings shall not be erected unless fitted with arrangements for heating and cooking by means of gas or electricity. The interesting statement was made by Mr. Chamberlain that in 75 p.ct. of the new houses which have been erected, gas-stoves have been installed—apparently he refers to gas-cookers. But he considers that it would not be wise to make the clause operative in respect of existing dwellings, because, in our present state of knowledge, it would be too great an interference with private liberty. That is an interesting statement to come from the Minister of Health; and we cannot reconcile it with the action of those corporations who administer electricity undertakings, and who in some of their housing schemes have interfered with the liberty of the tenants to the extent of compelling them to use electricity, despite its great

cost for heating purposes, instead of other more economical fuels. He points to the cheapening of gas and electricity and the production of smokeless fuel as being the ways of accomplishing the end; and, when the right time comes, it will always, he says, be possible to amend the Bill by inserting a provision to allow local authorities to exercise control over the burning of raw coal in grates. Lieut.-Commander Kenworthy considers it is a blot on an otherwise excellent Bill that nothing effective is being done in it to deal with the domestic fire; and Sir Alfred Mond also thinks that, unless domestic smoke is dealt with, there will be a risk of harassing manufacturers without improving the atmosphere. His view is that the opportunity should be taken of tackling the problem as a whole. Sir K. Wood, the Secretary to the Ministry of Health, points out that there are about twenty million coal fires in private houses in this country. His opinion is that more can be done by education than by any attempt to prohibit such fires. The Bill was given a second reading.

### A Universal Smoke Abatement Exhibition.

Smoke abatement is very much to the fore at the present time; and the discussion last week in the House of Commons shows that our legislators have the matter well in mind, with a distinct view existing among them that something more than the Government have proposed should be done to assist forward the work of suppressing—by progressive steps—the use of raw coal for domestic purposes. A Universal Smoke Abatement Exhibition is to be held at Bingley Hall, Birmingham, from Sept. 6 to 18; and a special article on the event appears in later columns. There is no question that on this occasion the competitors of gas and gas coke will be doing their level best to demonstrate their own virtues; and gas must not be behind, but must be superior to, them in making displays of what it can do in the service of the community—thus aiding by its adoption in purifying the atmosphere of our cities and towns. It is understood that Sir Arthur Duckham has consented to lecture in the Conference Hall of the Exhibition on Thursday, Sept. 16; and Mr. F. C. Briggs, the President of the Midland Association of Gas Engineers and Managers, states that an official visit of the Association will, in all probability, be arranged for the same afternoon. Most of the space available on the ground floor of the Exhibition has already been booked; and it is therefore essential that those manufacturers in the gas industry who desire representation should immediately make application for space; otherwise, we fear, they will be disappointed. The Hon. Secretary of the Gas Sub-Committee of the Exhibition is Mr. R. J. Rogers, Gas Department, Council House, Birmingham.

### More Money for the Company Promoters.

With "June, 1926," at the foot, and not the day of the month, a fresh prospectus has reached us which has been issued by the Southern Counties Electric Light and Power Supply, Ltd. In this prospectus, apparently care has been taken to omit reference to the too well known address 43, Cannon Street. Former issues of the same prospectus were dated February, 1926, Oct. 12, 1925, March 23, 1925, so that it will be seen these people have been making a fresh appeal for money about every six months. It is noticed that in the first-mentioned prospectus, the names of Mann and Martin appear as members of the directorate. They have dropped out; and Capt. E. F. Hill has joined on the Board Soame (the Baronet), Calvert, and Brigden. The capital now sought is 3677 8½ p.ct. participating preference shares of £1 each at par (tax free); 17,395 ordinary shares at 4s. per share (being of the nominal value of 1s. each, the impudent price asked represents 300 p.ct. premium); and £10,560 7 p.ct. first mortgage debentures, in 1056 multiples of £10 at £9 10s. each—that is, £95 per £100—redeemable at £105 p.ct. The tempting bait is held out to greedy speculators that six months' accrued interest will be payable on July 2 next. We hope that few will bite at the bait. In an accompanying letter, speculators are invited to make "early application." They need not worry about being early, for the people who are inviting this capital always have coffers open for additional contributions. No information is given as to prospects; nothing is said as to business done. The omission of information is the salient feature of this prospectus. Over a long period now we have heard of these people having a system for generating electricity which is going to knock into a cocked hat the most approved practices of our expert electrical engineers. A new version of the use of this miraculous invention for capital-raising purposes is as follows: "This Company will shortly have in operation a new and patent power-producing demonstration plant and power station which the Company has obtained the right to use. It is claimed that, by the use of such plant, the cost of fuel for, and production of, electricity is reduced considerably below that of coal or oil in the generation of electricity. Such plant is the first to be installed in England. In view of the present position of the coal industry, a patent process which can generate ample supplies of electricity for lighting, heating, and power, with the minimum use of coal, deserves very serious consideration, both in the national, as well as the shareholders' interests." How can anyone give it "serious consideration" on the quoted statement, which carefully hides all that it is essential to know? As the proposed plant will be "the first to be installed in England" (if it ever gets erected), will the generous persons who are the self-appointed custodians of the electricity supply of the "Southern Counties," which are not altogether destitute of electricity systems, tell us where the plant can be found?

### Trade Union Law.

Since the general strike, the feeling has spread throughout the country that it is high time there was a revision of the law affecting trade unions; and the Government find that, among their following throughout the country, there is a strong wish for definite action to be taken in the matter. This was obvious from the proceedings of the Central Council of the National Union of Conservative and Unionist Associations held last week. Resolutions were passed dealing with the Trade Disputes Act, 1906, and other matters affecting trade union procedure. One of the resolutions was: "That this Council urge His Majesty's Government to introduce early legislation to restore freedom of action to British workers, to secure for them the right to work, and to absolve them from penalties for non-compliance with a strike order unless their individual opinions on the matter in dispute have been sought by a secret ballot." Also at a meeting of the Unionist Home Affairs Committee, held at the House of Commons on Thursday, it was unanimously decided to introduce a Bill this session to amend the trade union law. The Home Secretary was asked to convey the sense of the meeting to the Prime Minister.

## PERSONAL.

After 53 years' service, Mr. E. Y. Wood, Secretary of the Weymouth Consumers' Gas Company, has resigned. He has been granted a handsome retiring allowance.

Mr. J. H. G. Saddington, the Eastern Counties' Representative of Lighting Trades, Ltd., of Garratt Lane, Wandsworth, S.W., was married to Mrs. H. Sutton, on June 24, at All Saints' Church, Wandsworth.

Members of the gas industry will be pleased to hear that Mr. W. M. Hampton, B.Sc., A.I.C., has been awarded the degree of Ph.D., at London University, for a thesis on "The Annealing and Re-Annealing of Glass." Dr. Hampton's early training was obtained at the Leicester Corporation Gas Department, from 1912-17, under Mr. Hubert Pooley, M.Inst.C.E. Since then he has been engaged on research by Messrs. Chance Bros. & Co., Ltd., Smethwick.

## FORTHCOMING ENGAGEMENTS.

**July 13.**—National Gas Council.—Meeting.
**July 13.**—Federation of Gas Employers.—Meeting.
**July 19.**—Institution of Chemical Engineers.—Annual meeting.
**July 19-23.**—Society of Chemical Industry.—Annual meeting.
**Sept. 6-18.**—Smoke Abatement Exhibition, at Birmingham.
**Sept. 9.**—"B.C.G.A.," Midlands District Conference.—Smethwick.
**Sept. 14-16.**—Institution of Public Lighting Engineers.—Conference at Newcastle.
**Sept. 20.**—Evening Star Lodge.—Emergency Meeting.

Institution of Gas Engineers.

**July 12.**—Emergency and Finance Committees.
**July 13.**—Advisory Committee on Education.
**July 24.**—Education Conference.
**Sept. 21-23.**—Postponed Annual Meeting.
**Sept. 24.**—Visit to Hastings.

# ELECTRICITY SUPPLY MEMORANDA.

OUR friend "Meteor" of the "Electrical Times" does not think much of the work of Standing Committee C, who are dealing with the Government (Electricity Supply) Bill. We hope the members of the Committee will not see his comments upon their proceedings. He states that "they are loaded with futile and often obstructive twaddle calculated to make any electrical expert, whatever his views of the Bill, gnash his teeth." Again, he states that he cannot commend the Government's conduct of the Bill. That is naughty. Generally his idea of what the Committee are doing is summed-up in these words: "The Committee are supposed to be weaving a piece of legislative tapestry with an intricate yet harmonious design. What they are likely to produce under present conditions is a belated and botched example of crazy patchwork." After that the Committee ought to be relieved of this particular job.

**The Electricity Supply Bill.**

In the "Memoranda" in the "JOURNAL" for June 2, we indicated the terms of clause 1 of the Bill, as amended by the Standing Committee. Regarding clause 2 as it now appears, it provides that the Board shall be charged with the duty of supplying electricity to authorized undertakings; but they are not themselves to generate electricity, save as expressly provided by the measure. It will, however, be lawful for them to enter into arrangements with any authorized undertakings for the exercise by them, on behalf of the Board, of any powers which the latter may think can more expediently be exercised locally. In clause 3, the Board are given power to appoint one or more consultative technical committees, consisting of engineers employed in connection with undertakings owning "selected" generating stations. The functions of such committees will be to give advice and assistance on such matters as may be referred to them by the Board. The first part of clause 4 (as it now stands) places upon the Electricity Commissioners the duty to prepare, and transmit to the Board, schemes relating to the respective areas. These will determine which generating stations (whether existing or new ones) shall generate for the purpose of the Board. Interconnection will also be provided for between the selected stations and the systems of authorized undertakers, as well as such standardization of frequency as may be essential to the carrying-out of the proposals for inter-connection. Other subsidiary matters are dealt with. As will be remembered, generating stations belonging to railway, canal, inland navigation, dock, or harbour undertakers, are exempt from inclusion in the scheme as selected stations, as are also private stations, without the consent of the owners. Public notice of each scheme is provided for; and the duty of carrying it out, and giving effect to it, is placed upon the Board. Then comes the new provision allowing appeals by authorized undertakers who consider that any obligations proposed to be imposed upon them will be prejudicial to them. But the arbitrator is not to grant any relief, other than pecuniary compensation, in any case where the Board certify that its grant would conflict with the basic principles of the scheme, or would adversely affect its efficiency.

**Amended Clauses.**

The Incorporated Municipal Electrical Association have been meeting in Glasgow under the presidency of Mr. R. B. Mitchell, the Chief Engineer and Manager of the Corporation Electricity Department. The Presidential Address was largely devoted to a lightly sketched statement of the impressions and information gained by Mr. Mitchell during a recent tour of the principal cities of the United States and Canada. As can be appreciated, the sky-scrapers of New York City cause a greater consumption of electricity per square foot of area than in any other city of the world. In one part of the area, one-quarter mile square, the density is estimated to be at the rate of 280,000 KW. of actual load per square mile. But in electricity supply, as well as in some other directions, our American friends appear to allow their highly developed *penchant* for enterprise to overstep the bounds of prudence. They carry their electrical cables into rural areas where consumers cannot average more than five to the mile; and the load cannot possibly be remunerative for long to come. Generally, charges for rural supply are the same as for the metropolitan areas. The suppliers believe that the bad should be taken with the good; and manifestly the Government of this country think the same, though the electricity industry harbours other views on the matter. Taking the bad with the good means that the consumers in the profitable areas are the sufferers. But Mr. Mitchell gives those who have supported the Government Electricity Bill something to think over. If they wish to get to the reason for the larger consumption per head of the population in the States than here, they must dig deeper into relative facts, and not confine themselves to charges. Mr. Mitchell says the rates of charge in this country compare favourably with those in American cities—in many of our undertakings they are much lower. This is a matter upon which the error of a contrary view exists in this country, and that error has been fostered by some of the supporters of the Government Bill. Mr. Mitchell is of opinion that "it is time an emphatic contradiction was tabled." The fact that prices are lower here than in the States, and yet the consumption per head of the population is much higher (even excluding the railway load), shows that the conditions in the two countries are not parallel. In the States, the people are accustomed to pay more for service than here; and yet the industrial power and domestic lighting loads have reached big dimensions there. The President remarks that in America the ordinary consumer, although well-to-do, uses electricity for lighting, and in his household there may be an iron and a vacuum sweeper; but the rates of charge do not permit of the use of electricity for much else, and a three-unit fire would be quite out of the question. The address shows, however, that the American suppliers are eager for domestic development, and are adopting large-scale methods—including showrooms and service—to realize their aim. In the foregoing, it is seen that charges for electrical current in the States are not lower than here. Yet larger units of generating plant are employed, and the loads are heavier. What support do the British Government find in those conditions for their electrical policy?

**Conditions in the States.**

For these abnormal times, a curious letter by "F. T." has been published by the "Electrical Review." The writer suggests that the facts he puts before the readers of that paper should be made use of by the "E.D.A." He points out that during the strike people are requested to use less gas and electricity, thereby cutting-down the quantity of coal used at gas and electricity works. He recognizes a big difference between quantity and quality. He refers to the "rotten gas supply" he is receiving at his house; and he wonders whether "our gas friends are quite as patriotic as their electrical competitors, whose supply cannot be deteriorated." This individual obviously does not appreciate the seriousness of what he is writing about; and we do not think the "E.D.A." will adopt his senseless suggestion that the conditions existing during this time should be made use of for electrical propaganda purposes. With over 8 million gas cookers in use, to say nothing of other countless domestic and industrial appliances, the gas industry is a large user of coal; and had it not been for its gas and coke supplies during these critical months, the country long before this would have collapsed under the strain to which the Miners' Federation have subjected it. Directly the general strike started, the gas undertakings were notified by the responsible Government Department that they might reduce the pressure at those times of the day when the demand was low, in order to meet the demand when gas was most needed. Then, further, "with the object of effecting the greatest possible saving in the use of coal, water gas shall be substituted for coal gas to the fullest extent practicable, and undertakers who by reason of following such directions are prevented from making a supply of gas of the prescribed quality to any consumer shall, to that extent, be deemed to have fulfilled their statutory or other obligations to make such supply." The gas industry has spent hundreds of thousands of pounds in providing for this strike, and is still spending heavily in order to prevent a breakdown of a highly essential service to the community. Is "F. T." or the gas industry unpatriotic? "F. T." is apparently a man who does not hesitate, if he finds an opportunity, to "hit below the belt." People who indulge in that sort of thing are cowards. We are surprised that the "Review" published the letter. We do not think the "E.D.A." is likely to do anything so devoid of common sense as to act upon the "tip" of "F. T."

**The "Unpatriotic" Gas Industry.**

Our electrical friends state that 85 p.ct. of the dwellings in this country represent for them virgin soil. We do not know why they should look upon that 85 p.ct. as virgin soil, seeing that it has already been largely cultivated by the gas industry, which holds possession of it, and, if its units are wise, will not allow the business to depart from them. However, a bold effort is going to be made in the coming autumn by the "E.D.A.," in conjunction with the Electric Lamp Manufacturers' Association, carrying on a public campaign of great intensity; and this is to continue from October to April. The campaign, it is stated, will proceed under the title of "Wiring for the Homes of Britain." It is no doubt thought that, in view of the large adoption of the assisted-wiring policy by electricity undertakings, this is an opportune time to do good business. The attack is to be made through electric lighting; and then, whenever it is established, the assault will be carried on to cooking and heating. The programme for this big campaign includes competitions for non-electrical people, who will be called upon to study advertisements published in newspapers and journals having an aggregate circulation of about 14 million copies. They will also—apparently in order to qualify for the competition—have to read a book which is being pro-

**Autumn Campaign.**

duced by the "E.D.A.," as well as engage in a ballot. The prizes are to be of a sumptuous order. The first one, it is stated, will be a valuable electric house; and the other prizes will consist of hundreds of pounds worth of electrical equipment. Exhibition electrically-equipped houses will be established in many areas, and meetings and so forth are being arranged. In the idea of the competition, the electrical people are following the effective work in the same line last year of the British Commercial Gas Association.

**Fatalities and Other Accidents.**

The record of fatalities, interruptions of supply, and other accidents connected with electricity maintains an unbroken line. We see that at Redcar an inquest has been held on Henry Nellist, a boy of 16 years of age, who happened to touch some three inches of non-insulated wire attached to an electric light ceiling fitting, and received a fatal shock. A verdict of "Accidental death" was returned. John Ryan, age 36, on the 10th inst., at one of the generating stations of the Manchester Corporation received burns of such a serious nature that he died in hospital the same day. The danger of overhead wires was demonstrated the other week near Doncaster, when a schoolboy named George Crich, age 13, was tempted to climb an electric power standard. When he reached the top, he appeared to have caught hold of the wire, when there was a noise like an explosion, and flashes came from the boy's legs. After a few minutes, before assistance could be obtained, the boy fell dead from the standard. Another boy was found dead on the Riverside route of the L.N.E.R. on June 10. Apparently the boy had wandered on to the line, and had tripped over the "live" rail. A fire recently broke out in the joiners' shop at the works of a builder and contractor in Mansfield. The reporter states that it is believed the outbreak was due to the fusing of an electric wire. Of course, our electrical contemporaries—probably knowing nothing about the matter—will say he was wrong. A L.C.C. tramcar, crowded with passengers, caught fire on June 15 at the Elephant and Castle, with the result that the traffic was temporarily disorganized. Flames shot out from beneath the under-carriage, and the passengers made a hurried exit. Fortunately no one was injured. A fault on one of the 33,000 volt cables connecting the Barton generating station of the Manchester Corporation with the city resulted in an almost complete failure of the supply on June 13. The central part of Stockport also suffered an interruption of the electricity supply on June 14.

# GAS REGULATION ACT, 1920.

## Coal Emergency, 1926.

The Board of Trade, in exercise of the powers conferred upon them by the Emergency Regulations, 1926, and of all other powers enabling them in that behalf, have given Coal (Emergency) Directions, dated May 1, 1926, Part VII. of which applies to all persons who manufacture or supply gas whether under statutory authority or otherwise, and to all gas-works throughout Great Britain. By these Directions the production and supply of gas manufactured from coal shall be replaced to the fullest extent practicable by the production and supply of gas manufactured from coke and steam, including carburetted water gas; and any coal required for the manufacture of gas shall be utilized in such a manner as to effect the greatest possible saving in the consumption of coal, while the pressure at which gas is supplied at certain times is in certain circumstances to be reduced to the lowest possible.

Now therefore, we, the undersigned Gas Referees, appointed under the Gas Regulation Act, 1920, hereby notify that in any quarter during the whole or part of which the Coal (Emergency) Directions, 1926, are in force, the form of quarterly report given in the appendix to this supplement to the general notification shall be substituted for the form of quarterly report given in Appendix "J" of the general notification of the Gas Referees or in an appendix to a current special prescription of the Gas Referees. The dates inserted in the form in the appendix hereto are specimen dates applicable only to the quarter ending June 30, 1926, and shall be varied as required for any subsequent quarters.

The average calorific value of the gas supplied by the gas undertakers for each of the periods given in the report shall be ascertained by the gas examiner from the results of all the official testings in the period in question in the manner provided in the general notification of the Gas Referees for ascertaining the average calorific value of the gas supplied for the quarter. The gas examiner shall report the average calorific value for any period as "not ascertainable" in any case in which not more than one testing in that period has been made, and the result of that testing is below the declared value. In exceptional circumstances the Gas Referees will instruct the gas examiner as to the manner of ascertaining the average for any period.

This supplement shall be applicable to all undertakers for whom we have issued special prescriptions under the Gas Regulation Act, 1920; and a form of report as given in the appendix hereto shall be used by gas examiners duly appointed to make testings under the Gas Regulation Act and our prescriptions. This supplement shall be in force in each quarter during the whole or part of which the Coal (Emergency) Directions, 1926, are in force, and in no other quarter.

C. V. Boys,
W. J. A. Butterfield,
J. S. Haldane,
Gas Referees.

*Office of the Gas Referees,*
*66, Victoria Street, S.W. 1.*
*June 23, 1926.*

### APPENDIX.

Gas Regulation Act, 1920.

Coal (Emergency) Directions, 1926.

The.....(*name of gas undertaking*).
GAS EXAMINER'S REPORT for the Quarter ended....., 192...
An Order dated....., having been made by the Board of Trade under section of the Gas Regulation Act, 1920, and the..... ..... having given notice of their intention to supply gas of a calorific value of..... B.Th.U. per c.ft. as from the.....at which value 1000 c.ft. are equivalent to.....therms, the gas undertakers are required by the provisions of the Act to supply gas which, when tested in accordance with the provisions of the Act and the Prescription of the Gas Referees, shall be:

(1) Of an average calorific value in any quarter of not less than .....B.Th.U. gross per c.ft.
(2) Of a calorific value on any day for any period of two hours or upwards not as much as 6 p.ct. in defect of .....B.Th.U. gross per c.ft. (a "complete 1 p.ct. by which the calorific value is deficient in excess of 5 p.ct.").—Gas Regulation Act, section 9 (1) (3).
(3) Free from any trace of sulphuretted hydrogen, and
(4) At not less than .....in. (of water) pressure.

The Board of Trade, in exercise of the powers conferred upon them by the Emergency Regulations, 1926, and of all other powers enabling them in that behalf, have given Coal (Emergency) Directions, dated May 1, 1926, which include, *inter alia*, directions to gas undertakers, of which clause 29 reads as follows:

> Where any person supplying or offering to supply gas for reward is by reason of the provisions of these directions prevented from making a supply of gas of any prescribed quality to any consumer, such person shall to that extent be deemed to have fulfilled his obligations, whether created by Statute or otherwise, to make such supply.

Clause 44 of the Coal (Emergency) Directions, 1926, states that they shall come into force on the first day of May, 1926.

I, (WE), the undersigned, having been appointed gas examiner (s) for the districts of the local authority (ies) named below, HEREBY CERTIFY that in the quarter ended.....the gas supplied by the.....in the districts of that local authority (ies) has been tested in accordance with the provisions of the Gas Regulation Act, and the Prescription of the Gas Referees appointed by the Board of Trade under that Act, with the following results:

| | B.Th.U. per c.ft. |
|---|---|
| Average calorific value for the period April 1-30 | |
| Average calorific value for the period May 1 to June 30 | |
| Average calorific value for the quarter | |
| Number of days between April 1 and 30 on which the calorific value was found to be deficient by 6 p.ct. or more | |
| Number of days between May 1 and June 30 on which the calorific value was found to be deficient by 6 p.ct. or more | |
| Sulphuretted hydrogen: Found to be present on | days |
| Number of testings between April 1 and 30 in which the pressure was found to be less than | in |
| Number of testings between May 1 and June 30 on which the pressure was found to be less than | in |

Date .....

.....
*Gas Examiner(s)*
appointed for the districts of
.....
.....
.....
.....
*Name(s) of local authority(ies).*

Unless the gas examiner has been notified of an appeal—*vide* Appeals and Amended Reports, "General Notification," p. 19—this quarterly report is to be sent, not earlier than fourteen, but within twenty-one, days after the end of each quarter, to the Gas Referees, to the gas undertakers, and to the local authority(ies) or Quarter Sessions appointing the gas examiner.

# SOCIETY OF BRITISH GAS INDUSTRIES.

## ANNUAL GENERAL MEETING.

**MR. CHARLES CLARE.**
Founder. First Chairman, 1906–10.

**SIR ALFRED MOND.**
President, 1925–26.

**SIR DUGALD CLERK.**
First President, 1906–7.

**MR. B. B. WALLER.**
Chairman, 1925–26.

The adjourned Annual General Meeting and Dinner of the Society took place in the Hotel Cecil, London, W.C., last Wednesday, under the Presidency of the Right Hon. Sir ALFRED MOND, Bart., M.P., who delivered his address.

Mr. B. B. WALLER (as Chairman of the Council) occupied the chair during the earlier part of the procedings, as Sir Alfred Mond was unable to attend until later.

### MINUTES OF LAST MEETINGS.

The minutes of the last annual general meeting and of the autumn meeting were taken as read, and signed.

### REPORT OF THE COUNCIL.

The CHAIRMAN then presented the following report of the Council upon the work of the Society during the year 1925-26:

We have to record with regret the death of the following members:

Robert Dempster, Chairman, R. & J. Dempster, Ltd.
W. P. Gibbons, Chairman and Managing Director, Gibbons (Dudley), Ltd., and Gibbons Bros., Ltd.
Hubert Bewlay, Director, Thomas Piggott & Co., Ltd.
Albert E. Guest, Managing Director, New Conveyor Co., Ltd.
T. J. Ashley, Director, Aldridge & Ranken, Ltd.
Thomas Potterton, Senior Partner of the firm of Thomas Potterton.
Lawrence Clayton, Chairman, Clayton, Son, & Co., Ltd., and Goodall, Clayton, & Co., Ltd.
Arthur L. Lloyd, Chairman, Thomas Piggott & Co., Ltd.
A. W. Lamond, Director of J. & W. B. Smith, Ltd.

The Society wishes to offer its congratulations to Sir Robert Hadfield, Bart., F.R.S., who has been awarded the Cross of the Legion of Honour by the President of the French Republic, partly for services he has rendered to science and partly because of the excellent work he did at Wimereux for five years during the War with a hospital for wounded men. We also wish to offer our congratulations to Mr. D. Milne Watson, who has had the Degree of Doctor of Laws conferred upon him by the Leeds University.

We extend cordial congratulations to all members of the Society on the occasion of its 21st anniversary, and trust that the success which has attended its efforts over that period will be well maintained in the future. The aims and objects for which the Society was established have, it is suggested, been attained, the scope of its utility has been enlarged, and a wide field of useful work for the industry has been achieved by collective effort which, had it been left to individuals, might not have been accomplished.

*British Empire Exhibition, 1925—Gas Exhibit.*—The co-operative spirit in the gas industry has been again shown by the support given by our members to the Gas Exhibit at the British Empire Exhibition at Wembley, and, while thanking the members for their generous support, we should like to express our thanks to Mr. F. C. Tilley for the great interest and trouble he has taken in the work, and his fair-mindedness throughout in dealing with the various exhibits. We congratulate Mr. F. W. Goodenough, Chairman of the Executive Committee, on the well-deserved honour of Commander of the Order of the British Empire conferred upon him by His Majesty the King for valuable services rendered. The British Empire Exhibition Committee has awarded the Society a Bronze Medal in recognition of our co-operation in the Exhibition. The Cross-Word Competition in connection with the Gas Exhibit proved of great interest to visitors, and the entrants came from all parts of the country. The prizes were given by various members of our Society, and, judging by letters the Committee have received from the recipients, they have been very much appreciated.

*Retort Setters.*—The Manchester agreement between Section I. of the Society and the Amalgamated Union of Building Trade Workers, made in 1924, which expired on May 1, has continued to work satisfactorily. The few minor difficulties which have occurred during the year have been amicably and satisfactorily settled.

*Refractory Materials.*—The Members of Section X. continue to be intimately concerned with a considerable body of research on refractory materials which is being carried on at Stoke-on-Trent, under the direction of Dr. J. W. Mellor, by the British Refractories Research Association. A most comprehensive series of investigations has been undertaken into materials with a varying content of iron. Spalling, penetrability, diffusivity and thermal conductivity, slag action, and other inquiries are being pressed bearing respectively upon fireclay, siliceous, and silica products. Members have also been represented on the Refractory Materials Joint Committee, under the Chairmanship of Mr. John P. Leather. Here the framework of the Standard Specification comes into occasional review, and discussion on methods of testing refractories, the destructive action of coke and slags in contact with furnace linings, and other matters of similar import and interest are the basis of an interchange of ideas. Work of this character has for many years received the close attention and generous support of the members. Our numbers have grown, and it may be said that the outlook generally is satisfactory.

SOBCI

*Trade Mark.*—The trade mark can now be used by members on their manufactures in a diamond, as shown above. We hope many members will take the opportunity of using this, so that it may become a recognized guarantee or hall-mark of good quality and workmanship.

*Promotion of Reciprocal Good Feeling and Mutual Confidence between Members.*—This is a matter which has been under the careful consideration of the Council for some time, as it is felt that friction occasionally arises between members; and we are anxious to remove such feeling if possible. We have therefore decided that if any member has a grievance against another, and fails to settle it by personal negotiation, he can bring the case before the Secretary, who will then refer it to the Chairman for the time being, who will see if the matter can be settled in a friendly way, or, if necessary, refer it to the Council. The opinion has been expressed that if such an arrangement can be worked satisfactorily it will greatly strengthen our Society. We are very pleased to report that one case has already been amicably settled.

*Exhibitions.*—The question of exhibitions is engaging our attention at the present time, and we are aiming at better co-operation for the future. The British Commercial Gas Association have appointed a small Committee to confer with our Committee on the matter.

*Revision of Railway Classification of Goods.*—Messrs. Tweedy & Holt, of Halifax, have watched our interests at meetings of the Railway Rates Tribunal; and their reports on railway matters are issued in the Bulletin and the monthly letter to the members. We trust these have proved useful.

*Electricity (Supply) Bill.*—We view with apprehension the Electricity Bill, which has passed its second reading. While appreciating the high ideals of the promoters to supply a standard and cheaper supply of current, we feel—in common with the expressed views of many experts in electrical matters—that a dangerous precedent is being created in granting to the Electricity Commissioners autocratic powers—powers which, in effect, place them above Parliament and outside the scope of the Courts of Law. We are confident that the interests of the gas industry are being carefully safeguarded by the National Gas Council.

*British Commercial Gas Association.*—The propaganda work of the Association is proving beneficial to all engaged in the industry, and we were pleased to co-operate with them in the special autumn publicity campaign last year. The Gas Essay Competition has proved a great success; a very large number of entries having been sent in. Our best thanks are due to our members who assisted in the judging of the essays. The Committee of Judges for the final selection included Prof. Arthur Smithells, one of our Past-Presidents, and Mr. H. James Yates, one of our Past-Chairmen. We congratulate the Association on their very successful annual conference in Plymouth, at which a number of our members were present.

*Coke Competition.*—The awards for the papers in the Coke Competition (which were provided through the generosity of the Woodall-Duckham Companies) have been duly announced in the Technical Press. The money was allocated to three sections in the Competition, the first dealing with manufacture of coke, the second with preparation, and the third with sale, distribution, and use. The first prize was awarded to the staff of the Woodall-Duckham Companies, who very generously handed over the money (£200) to the British Commercial Gas Association. We are very pleased to note that

some of the principal awards have been gained by competitors connected with our Society. The adjudicating Committee in their report congratulate the winners of the chief awards upon their meritorious productions, and express the opinion that notable contribution has been made to the literature of coke manufacture and disposal, which should be incentive and guiding to the gas industry.

*Radiation Research Laboratories.*—The new Central Research Laboratories of Radiation, Ltd., at Radiation House, Grosvenor Place, S.W., were opened in October by Mr. D. Milne Watson, D.L. The laboratories will be for pure research work, and the Directors of the Company wish it to be known that these are open for the development of everything that is good in the gas industry. It is their intention to assist developments in every way they can. We congratulate the Company on the fine public spirit they have shown.

*Leeds University.*—Last autumn we received the Appeal from Leeds University for support for their Building Extension Fund. The University, as you are all aware, is closely connected with the gas industry through the Coal Gas and Fuel Industries Department; and the valuable work carried on there since its establishment has been of great service to our industry. We have decided therefore to give a donation of twenty guineas for five years, making a total contribution of one hundred guineas to that Department, and we feel sure this will meet with your approval. It is gratifying to note the very generous response which has been made to the Appeal; and we wish it complete success.

*City and Guilds of London Institute.*—The prizes in the City and Guilds of London Examinations in Gas-Works Practice, Gas Supply Practice, and Gasfitting have been duly awarded and announced in the Technical Press. These serve a very useful purpose by stimulating candidates to attend courses of instruction with a view to improving their knowledge, which is afterwards tested by examination; and from letters we have received, it is gratifying to learn that these awards are much appreciated by candidates and are very helpful to them in their further course of study.

*Membership.*—We are pleased to report that the membership of the Society is steadily increasing, and, with the formation of a Section for Contractors of Coal for Gas Manufacture, we welcome the addition of several important firms. Our total membership is now 136 firms. The addition to Rule VI. to provide for the new Section No. 14 was passed at the autumn meeting.

The Society wishes to accord its best thanks to the Right Hon. Sir Alfred Mond, Bart., M.P., for his valuable services during his Presidency. On his retirement he has been pleased to accept the office of a Vice-President, and we hope that we may long have the benefit of his counsel and advice.

We also desire to place on record our best thanks to Mr. D. Milne Watson, D.L., for his able and valuable address at the last annual meeting, entitled "Gas and Electricity in Relation to Unemployment and Industrial Depression;" also to Mr. B. B. Waller, A.M.Inst.C.E., Chairman of the Council, for his paper at the autumn meeting entitled "Co-operation in Industry," which led to a good discussion.

We have much pleasure in announcing that Viscount Ednam, M.C., has accepted the Presidency of the Society for the coming year.

On behalf of the Council,

B. B. Waller,

*Chairman.*

### The Report Adopted.

The Chairman said it was now his duty to move the adoption of the report; but, before doing so, he would like to enlarge upon one or two of the paragraphs contained therein. He would, however, endeavour to be as brief as possible in this, because they were anticipating a very valuable address from the President, which would certainly deserve all the time they could devote to it. He would like in the first place to extend a very cordial welcome to the members of the new Coal Section. He hoped that in joining the Society they would find the benefits that others who had joined in the past had derived from their membership. They could not but admire the work of the British Commercial Gas Association. The extraordinary growth in the use of gas that had taken place during the years that Association had been in existence was, he thought, largely due to the propaganda work and publicity which they undertook. Mr. Goodenough, at a recent meeting, had drawn attention to the fact that the actual cost of their publicity work was something like one-quarter of one per cent. on the sales of gas, which, of course, was an extraordinarily small figure for advertising on such a scale. The Association was deserving of the most generous possible support by everyone in the industry.

#### Exhibitions.

With regard to the "Exhibitions" item, he would remark that when the report was printed, the Council were not able to say much about the subject; but it had been under consideration for some time. It was a highly important question; and the views of the Council were that whatever was done in the way of limiting or dealing with exhibitions of various types and descriptions would be in the best interests of the gas industry as a whole, and not in any sense a personal matter so far as the members of that Society were concerned. There had been some apprehension, in putting forward the proposals they were doing with reference to exhibitions, that there might be a wide divergence of opinion; but he was pleased to say there was almost unanimity among exhibiting members and others that the proposals were wise and sound, and should lead to good results. The Sub-Committee dealing with exhibitions would meet a Sub-Committee of the British Commercial Gas Association and confer with them on the proposals and resolutions which the Council had made on this matter; and it was, of course, possible that the "B.C.G.A." might not see exactly eye to eye with them. They hoped, however, for the support and co-operation which would bring the question to a successful issue.

#### Reciprocal Good Feeling.

It was not necessary for him to enlarge much upon the paragraph relating to the promotion of reciprocal good feeling and mutual confidence between members; but he would like to say that the Council thought it was a very good arrangement. He could speak personally of the case that was referred to in the report—the only one that had been dealt with so far. The outcome was of a most pleasant character. It was a troublesome matter, and was quite legitimately brought forward. Both parties approached the question in a generous spirit; and the result was to clear away any ill-feeling that would probably otherwise have existed. He mentioned this as an encouragement to others to come forward in like circumstances. In connection with the work done by the Refractory Materials Section, he would like to mention Mr. Frank West, who had devoted a large amount of time to this important subject.

#### Twenty-First Anniversary.

Now he came to what was perhaps the most interesting paragraph in the report—that dealing with the Society's twenty-first anniversary. It was a great day for all of them; and he thought perhaps they would be justified in "blowing their trumpet" a little on the subject of the work which the Society had done since its inception. It was a matter of great congratulation to them all that their old and esteemed friend, and founder of the Society, Mr. Charles Clare, was with them that day [applause]; and also two of the original members of the Council—Mr. J. W. Broadhead and Alderman Fred. J. West. It must be a source of pride to all these gentlemen to realize what their work had developed into during these twenty-one years. He must refer also, in this connection, to their old friend Mr. Arthur F. Bezant, who, he thought, they might call the originator of the Society, because he believed it was from a series of articles he wrote that the idea first emanated. Then, again, as one of the old associates of the Society, mention must be made of their good friend and Secretary Mr. Arthur L. Griffith, who had seen a number of Presidents, Chairmen, and Councillors through difficult times with that loyalty and care with which he had always served them. The Society started with about 36 members, which had now grown to 136; and he attributed the success of the Society very largely to that spirit of co-operation in which they had always worked together, not only on the Council, but among the members themselves. Reviewing just one or two important pieces of work that the Society had carried out, he might refer to the standard clauses, which the whole industry had found of much benefit. Then, again, there was the wonderful work which the members had undertaken during the strenuous years of the war; and there was also the co-operative spirit that was shown in connection with the great gas exhibit at Wembley, where they worked with kindred organizations in the gas industry. Now they were housed in really fine offices in Westminster, thanks for which were largely due to Mr. Cutler for finding the premises, as well as to the support of the members in producing the wherewithal to keep them going. The accounts revealed that the Society occupied a strong position at the present time. They had now arrived at the age of 21, and he thought they could fairly claim that they had not had a misspent youth. The growth in the use of gas since the inception of the Society had been phenomenal, and had synchronized with the work that they had done during these years. The total increase in gas consumption during the past twenty-one years had, he believed, been something like 65 p.ct. This growth he ascribed to two factors. One was the intensive propaganda work of the "B.C.G.A.," and the other was the enterprise, research, co-operation, and good service of the members of their Society.

Alderman Fred. J. West said it was always an honour to second the adoption of the report, but especially so on the twenty-first anniversary of the Society. Reviewing the report, he thought the paragraph relating to the promotion of reciprocal good feeling referred to a matter which, among all the things they had achieved, stood out as the greatest. So long as a spirit of good feeling and comradeship existed among them, they would benefit the gas industry, they would benefit themselves, and they would justify the continuance of the Society. He would suggest to the Chairman that, before he handed over the reins of office to his successor, he might explain to certain sections how the proposed trade mark should be applied to such things as gasholders and vertical retort installations. [Laughter.]

The report was then adopted, as also were the accounts for the year 1925, on the proposition of Mr. A. W. Glover, seconded by Mr. H. J. Donkin.

### COUNCIL REPRESENTATIVES OF SECTIONS.

The CHAIRMAN announced that the following gentlemen had been elected to serve on the Council as representatives of the Sections:

| | | |
|---|---|---|
| Mr. J. W. Broadhead, M.I.Mech.E. | to represent Section | I. |
| Major Richard Miles, B.Sc. | " " | II. |
| Mr. Samuel Cutler, A.M.Inst.C.E., M.I.Mech.E. | " " | III. |
| Mr. R. J. Milbourne, J.P., F.C.S. A.M.Inst.C.E. | " " | IV. |
| Mr. Thomas A. Braddock | " " | V. |
| Mr. Cyril G. Davis, M.I.Mech.E. | " " | VI. |
| Mr. H. Talbot | " " | VII. |
| Mr. Thomas F. C. Potterton | " " | VIII. |
| Mr. John Orme | " " | IX. |
| Mr. Frank West, M.I.Mech.E. | " " | X. |
| Mr. H. J. Donkin, M.I.Mech.E. | " " | XI. |
| Mr. Arthur H. Lymn | " " | XII. |
| Dr. E. W. Smith, D.Sc., F.I.C. | " " | XIII. |
| Mr. Frederick Dobson, C.C. | " " | XIV. |

### NEW CHAIRMAN AND VICE-CHAIRMAN OF COUNCIL.

Mr. CHARLES CLARE said he felt it a great privilege to move the election of Mr. Frederick J. Gould as Chairman of the Council. Mr. Gould had been a member of the Society for many years, and had taken an active part in the work of the Council. He was in every way fitted to fill the position of Chairman.

Mr. FREDERICK C. TILLEY seconded the motion, which was carried unanimously.

Mr. GOULD said he deeply appreciated the honour that had been done him, and this honour was enhanced by the fact that Mr. Clare, the founder of the Society, had proposed the motion, and their old friend Mr. Tilley, a past Chairman, had seconded it.

Mr. SAMUEL CUTLER proposed the election of Mr. R. B. Hodgson as Vice-Chairman of the Council. He said that Mr. Hodgson had done a lot of work in a quiet and unobtrusive manner over a large number of years. He was associated with one of the best-known firms in the industry, and his services in the position proposed would be of great advantage to the Society.

Mr. R. J. MILBOURNE seconded the proposition, which was unanimously agreed to.

### OTHER OFFICERS.

Mr. Charles Clare was re-elected Hon. Treasurer, on the motion of Mr. CYRIL G. DAVIS, seconded by Mr. FRANK WEST.

The re-election of Mr. E. J. Davison as Hon. Secretary was agreed to on the motion of Mr. C. A. GOODALL, seconded by Alderman FRED. J. WEST.

Dr. E. W. SMITH proposed the appointment of Mr. B. B. Waller as an elective member of the Council. This was seconded by Mr. T. F. C. POTTERTON, and passed.

Moved by Mr. J. W. BROADHEAD, and seconded by Mr. CHARLES S. BENNET, Messrs. Frederick C. Tilley, J. Wilfrid Drake, and C. A. Goodall were appointed elective members of the Council.

The re-election of Messrs. Cash, Stone, & Co. as Auditors to the Society was agreed to on the motion of Mr. THOMAS A. BRADDOCK, seconded by Mr. JOSEPH TAYLOR.

The Council were thanked for their services during the past year, on the proposition of Alderman GEORGE CLARK, seconded by Mr. CYRIL G. DAVIS.

### PRESENTATION TO THE SECRETARY.

The CHAIRMAN, proposing a similar compliment to the Hon. Treasurer, the Hon. Secretary, and the Secretary, said the balance-sheet showed what their Hon. Treasurer did for them; while the Hon. Secretary also did important work. As to the Secretary, it was always a pleasure to testify to the excellent way in which Mr. Griffith carried out his duties; and on this occasion he was glad to be able to do a little more than that. The Council felt that this twenty-first anniversary offered a suitable opportunity of recognizing in a tangible manner the work of Mr. Griffith; and he had great pleasure in presenting that gentleman with a cheque for fifty guineas. [Applause.]

Mr. JOHN ORME seconded the vote of thanks; and it was heartily agreed to.

Mr. GRIFFITH, on behalf of the officers named, returned thanks. Speaking for himself, he expressed his gratitude for the handsome present that had just been made to him, and his appreciation of the kindness and courtesy he had received from everyone connected with the industry during his Secretaryship—which covered the whole of the time the Society had been in existence.

Sir ALFRED MOND then proceeded to deliver the following Presidential Address.

**MR. ARTHUR L. GRIFFITH.**
**Secretary of the Society.**

## PRESIDENTIAL ADDRESS.

I esteem it a great privilege to be permitted to preside over this meeting, which celebrates the coming-of-age of the Society of British Gas Industries. The success which has followed the history of the Society during the twenty-one years of its activity is a testimony of the good purposes for which the Society was founded, and is a splendid augury for its future usefulness. The Society has now reached its first flush of manhood. The original scope of its activities has been enlarged, its utility has been increased, and all the indications point to still further fields of effort and endeavour.

There has been no time in the history of the gas industry—or, indeed, in the general industrial history of the country—when greater service could be rendered, not only to each particular industry, but to the community at large, than the present. The changes in British—indeed, in international—industrial history, which were so apparent during the years immediately before the war, have had their speed greatly accelerated by the financial and commercial position which the war and the subsequent peace, produced. Economic necessity has been even more rigorous in its application; the efforts of the workers to obtain a higher standard of living have been faced with depression in trade, and in many cases by an urgent necessity for restriction in output, with its consequent unemployment and financial stringency.

Generally speaking, the staple industries of the country have failed to maintain their progressive position, and the present troubles in the coal industry have retarded the nation's revival in a great number of industries, dependent upon it for a principal raw material. During all these years, however, the gas industry shows a gradual but definite increase in its volume and in the services which it renders equally to the industrial and domestic communities. Already the industry has 8¼ million registered customers, deals with 17 million tons of coal per annum in its 1500 undertakings, produces annually 280,000 million c.ft. of gas, and places at the disposal of the community about ten times the amount of heat energy provided by all the electricity public supply stations. Given the opportunity which industrial revival will promote, the gas industry will still further increase the number of its customers and the consumption of its product.

### THE COAL DISPUTE.

I am sure that you will bear with me if, before I speak further of the gas industry and its future, I deal at some length with the present coal dispute in a broad and fundamental fashion—for the future of the gas industry is inextricably interwoven with the future of the industry from which it draws its main raw material. Amid all the fluctuating statements and views which have abounded during recent years upon the basic fact of the coal industry, it seems difficult to express briefly what the real position actually is.

It would not be far wrong, however, to state that on the one hand the world demand for coal has diminished by the utilization of other forms of heat and power, while, on the other hand, the world capacity of production has increased by the exploitation of new coalfields, and in some countries by the utilization of speedier and more up-to-date methods in the mining of the product. Further, if we compare the number of people employed in the coal industry in England and Wales, as given in the censuses of 1911 and 1921, we find that the total has increased from 971,000 to 1,133,100. At a time when there has been a restriction in demand, it will be readily realized how serious is the effect upon the prospects of the whole industry of such a great percentage increase in the number of those employed in it.

To meet this basic position, careful consideration of the whole of the relative facts with calmness and deliberation is essential. Instead of this being possible during a period of freedom from industrial disputes, the coal industry has been disturbed by a series of recurrent crises. A main feature of these recurrent crises, on the one side, has been an incessant demand for higher wages and shorter hours, with, on the other side, an equally myopic view—the position that the only way to rescue the in-

dustry from disaster is by thinking and arguing in terms of wages and hours alone.

From the most recent utterances of some of those who claim to lead the miners, it seems fairly clear that the general atmosphere is now one in which the mining community would consider a reduction of wages or an increase in hours at least temporarily, provided there was a definite assurance, supported by some immediate action, that the re-organization of the industry, recommended in the report of the Royal Commission, would be begun forthwith. Yesterday the Government presented to the House the Mining Industries Bill, which contains provisions, in the words of the Bill itself, "for facilitating the working of minerals and the better organization of the coal mining industry, and with respect to the welfare of persons employed therein, and for other purposes connected with that industry." This Bill is important as representing the first official attempt to indicate what the Government understand by re-organization. Although its main provisions do not go further than facilitating amalgamations, it is at least an attempt to discover what measure of re-organization the miners will accept as a preliminary to concrete discussions on hours and wages, and a pledge of good faith that the Government propose to promote the re-organization of the industry.

### Hours and Wages.

Before dealing more generally with the question of re-organization, I should like to say a word or two about the hours and wages controversy. It seems to be widely held that there is something sacrosanct in the present hours of working in the coal industry. This is a complete fallacy. The Seven Hours Act was introduced in 1919 on the recommendation of the Sankey Commission; but it was especially pointed out by Mr. Justice Sankey that it was recommended only on the basis that there would be no falling-off in the output per man. No one can say that this has been the case; nor, in fact, is it at all clear that it was ever practicable to reach the same output with such a reduction in the working hours. The basis, therefore, upon which Parliament was induced to consent to this exceptional measure of legislating for hours in an important industry seems to me to have disappeared; and it appears to me that the industry ought to be made free again to adopt such hours as it may find necessary for its economic existence. Events have proved that you cannot legislate for hours if you do not legislate for wages. Hours and wages are so closely connected that by affecting one you concurrently influence the other.

The increase in wages given in 1924 was obtained under pressure and protest. It was based on the possibility of greatly improved prosperity in trade, increased consumption, and higher prices; but here, again, events have falsified the prophets. The increased consumption of coal has not been reached; the cost of living has diminished since the increase was given. How can it be logically argued that in an industry where there is under-consumption and intense world competition—which is, in other words, admittedly in a state of depression—wages should not come back to the pre-1924 basis? I want to emphasize most emphatically the fact, which seems to me to be continually overlooked by the miners' leaders, that their legitimate method of obtaining better wages is through the machinery of the ascertainment and the division of profits.

### Co-Partnership and Profit-Sharing.

When the 1921 agreement was made there was a sincere endeavour to place the coal industry upon a profit-sharing basis. That scheme shows many defects in practice, and needs revision; but the principle undoubtedly was, and ought to be, that all should share in the prosperity of the industry when it is prospering. The gas industry has for so long been sincerely interested in the whole question of profit-sharing, that I know I shall be excused if I digress for a moment at this point. A gas company was the pioneer firm in this country with a practical scheme of co-partnership; and no account of profit-sharing schemes is complete or convincing without reference to the great achievements of the gas industry in this direction. Profit-sharing has been of great value to the gas industry; and I am myself convinced that it can be of equal value to the coal mining industry.

The Royal Commission recommended that "profit-sharing schemes, providing for the distribution to the workmen of shares in the undertakings, should be generally adopted in the industry, and should be made obligatory by Statute." The Mining Industry Bill contains a provision "that it shall be lawful for any company being the owner of an undertaking consisting of, or comprising, coal mines, notwithstanding anything in the Memorandum or Articles of Association of the company, to establish and carry out a scheme for securing for persons employed by the company a share in the profits of the company."

While this does not carry out the complete recommendation of the Royal Commission, it is yet a step forward. While I am not prepared to wed myself at the moment to any particular scheme, I feel that the extension of profit-sharing advocated in the report of the Royal Commission by distribution of shares to the workmen in the undertaking does not provide sufficient elasticity. However well intentioned the profit-sharing scheme in the 1921 agreement might have been, it has suffered from its remoteness from the individual's daily work in the pit. It is now generally recognized that, if some modifications could be devised so that the cost of output as well as profits could be more directly related to the individual's work, it would be a great step forward. In this direction, I see not only the possibility of any reduction in wages, which may be necessitated immediately, being eventually more than recouped, but also the beginning of a spirit of better co-operation and greater interest on the part of those who are employed in the industry.

### Coal Selling Organizations.

To return to the problems of re-organization, my remarks upon wages and hours were preliminary and not exclusive. Recommendations regarding re-organization are an adjunct to the complete scheme. The mere reduction of costs at the pit will not in itself do all that is required. Over-production would still remain, both in Britain and abroad, and the economic result would be the sale of the product at a figure below the real economic value.

I have for several months, with increasing energy, been impressing upon mineowners, miners, and Ministers the value which would accrue to all concerned from the establishment of coal selling organizations in this country. Some months ago I invited two of the leading Directors of the Rhenish Westphalian Coal Syndicate to come across to inform me of the methods and administration of coal selling syndicates in Germany. There they have been in operation for over thirty years, with ever-increasing advantage to all engaged in the industry. The Rhenish Westphalian Syndicate itself controls more than 70 p.ct. of the total coal output in Germany. It has been in operation since 1893, and, owing to its size and efficiency, naturally has had a paramount voice and influence in the coal trade in Germany.

Since 1919 it has been a statutory requirement in Germany for coal producers to form themselves into selling syndicates for the disposal of the whole of their output; but it has not been necessary to put the Statute of 1919 into operation, as producers have voluntarily formed themselves into syndicates. The idea of setting up coal selling organizations in this country has been considered by an influential committee of coalowners, and the whole problem was investigated by a sub-committee; the relative papers and memoranda being circulated to each of the district associations of the Mining Association. The suggestions have met with a very sympathetic reception, and a considerable number of leading coalowners and some of the most formidable companies in the industry have given complete support to the suggestions. The districts of the Mining Association which have already given full consideration to the scheme have decided in its favour. For example, only this week I received information that at a meeting of representatives from eight district associations the opinion was universally expressed that some such organization was necessary for the successful carrying on of the coal industry. The districts reported that the majority of their members were in favour, and steps are now being taken for the drafting of a concrete scheme for the approval of the district associations.

The main outline of the proposals I have made is the formation of separate organizations for the selling of coal for the various coal producing districts. The organization would consist of all the producers in the area, and would control and market the whole of the coal output of its members. Output quotas on the average tonnage per colliery would be fixed, upon some such basis as the average output per colliery during the past three years. Facilities could be provided for the transfer of quotas and for penalties to be paid to the organization when the quota allotted is exceeded, and compensation to be paid by the organization when less than the allotted quota is disposed of.

Selling prices would be determined by the organization according to the class and quality of the coal. Liaison and co-operation between the various area organizations would be essential; and therefore the formation of a Central Selling Organization, which would determine the quotas of the various co-operations, adjudicate upon disputes between co-operatives, and co-ordinate their activities, particularly in the export trade, is a vital part of the proposals. If and when thought advisable, this Central Selling Organization would enter into arrangements with its opposite number in Germany or elsewhere for the exploitation of the export markets. I have been assured by most responsible quarters that such an understanding would be heartily welcomed.

The above suggestions are but a bare outline of the scheme; and much as I should like to deal in detail with the proposals, and with the results which would follow their adoption, to-day I will content myself with laying special emphasis upon two points. First, a scheme for a selling pool does not necessarily eliminate the merchant, especially in the export trade, where he is an absolutely essential pivot of our coal distributing machinery. Secondly, there need be no fear that the establishment of coal selling organizations would lead to excessive prices. Where they have been adopted in other countries, the necessary precautions have been taken to protect the interest of the consumer. Stabilization of prices does not necessarily mean undue raising of prices, either to the home consumer or to the export market The consumer, particularly the industrial consumer—for instance, the gas industry—is more interested in seeing ahead the course of prices in raw materials for a number

of years than in enjoying any small temporary advantage which may be secured by abnormal conditions.

### AMALGAMATION.

The formation of coal selling organizations is, however, only one aspect of the re-organization which is necessary in the coal trade. Here, as in Germany, the establishment of selling organizations would not only control output and stabilize prices, but would lead to the amalgamation of mines and groups of mines. If amalgamation or grouping, as the result of the establishment of coal selling organizations, proved tardy, it could be accelerated by the functioning of a Board of Commissioners who had inducements in the way of cheap credit and other advantages to offer.

Partly consequent upon amalgamation, and partly concurrent with amalgamation, would be various improvements in the methods of mining, such as more general adoption of coal cutting machinery, and use of underground conveyors and haulage. With a view to the concentration of output, central workshops and stores would all contribute to economical working, and central staffs of skilled engineers and mechanics would be available to give efficient supervision and maintenance. The potentialities of collieries could be developed. Screening, cleaning, carbonizing, and power supply plants could be concentrated at central stations. Smalls and slacks could be carbonized to make blast furnace coke and smokeless fuel for domestic and industrial purposes. Surplus electricity, gas, and bye-products from the carbonizing plants could be utilized. The sale of all surplus gas would be made to local gas undertakings for industrial and domestic purposes. The remainder of the coal which would not be carbonized could be dispatched from the central station as well-graded clean coal, the high economic value of which would bear the cost of transportation.

### OIL FROM COAL.

Increasing attention has recently been given to what is called the "oil from coal" problem. This is one of the most important developments in the treatment of coal, and by its solution a large portion of the surplus coal production in Europe would find legitimate use in supplying the ever-increasing demand for oil fuels, and render countries like our own immune in war time from the necessity of importation of one of the most vital essentials for our navy and our army. It is certain that the problem is passing from the theoretical to the practical stage. In both the United States and Germany it is already being dealt with on a commercial scale. Mr. R. J. Campbell, of the United States Geological Survey, wrote in a recent report:

> It is reasonable to expect in relation to the near future that 100 million tons of bituminous coal will be carbonized at low temperature in the United States. This quantity would yield 600 million gallons of motor fuel, or 8 p.ct. of the 1924 requirements. Another reasonable expectation is that super-power stations will carbonize at low temperature and generate steam from the pulverized residue. The 60 million tons of coal burned under power plants would thus provide 360 million gallons of motor fuel, which, added to the yield from plants making domestic fuel, would furnish 960 million gallons, or 13 p.ct. of America's annual requirements.

In Germany, a process has been working for two years on a full commercial scale, supplying its products to the market; and that process is now being extended. A report from the firm describes the process as a definite commercial success and "capable of converting low-grade fuels and mine waste into a valuable commercial product." From low-grade coal costing 8s. 6d. per ton, commodities, including semi-coke (smokeless fuel), tar, motor spirit, and gas, were obtained to the value of 22s.; and from raw coal costing 15s. per ton, similar commodities to the value of 31s. were obtained. The smokeless fuel is suitable for domestic purposes, the tar is of a very high quality, and the gas in Germany is supplied to towns, which in many cases are situated 100 miles away from the plant.

But the solution which is finding most favour at the present time is in the direction of high pressure and high temperature. The ingenious process invented by Dr. Bergius has been experimented upon for some time; and I understand the "I.G."—the big German chemical and dye combination—have recently stated that they are installing a plant on this principle. It is estimated that within two years an annual output of 250,000 to 300,000 tons of synthetic motor fuel will be possible, which means that Germany will be able to supply about 50 p.ct. of her consumption of motor fuel. Other processes on similar lines are being tested. In fact, the field in this direction of the synthetic production of oil opens up an unlimited vista of future possibilities.

### A NEW SPIRIT NEEDED IN THE INDUSTRY.

I hope I have said enough about re-organization in the coal industry to make it clear that fundamental changes have to be undertaken. Nor am I neglectful of the necessity for a new spirit throughout the industry. Until the workers are convinced that everything possible is being done to enable the industry to pay them an adequate wage, there will be no peace within the industry; until the workers are given a share and a direct share in the profits of the industry, there will be no inducement for them to regard their work as anything but a daily task. Unless the owners are prepared to take the men into their confidence, and to say that their industry is not as completely or efficiently organized as they fondly believe it is, and until the latest results of science and research are applied in both the production and the utilization of coal, there can be neither peace nor prosperity within the industry, nor that progressive revival of British trade which everyone so earnestly desires.

### THE PART OF GAS.

In this complete reconstruction and new orientation of the coal industry, the gas industries of this country have a fundamental part to play. If only the coal industry were as well organized as the gas industry, many, if not most, of the troubles of recent years could have been avoided, or at the very least postponed. In the development process of the distillation of oil from coal, and the scheme for central pithead stations for the treatment of coal, the gas industry as at present organized is a basic factor. From these developments the gas industry could secure large sources of fresh supplies of their product at a low rate. In the concluding part of my address, therefore, I would like to say a few words upon a matter which is of immediate interest, and of still greater potential importance—the utilization of industrial sources of gas supply.

I understand a list has been compiled of about 3000 distinct trades in which gas is known to be used for industrial purposes, and that in each trade it is employed on an average for seven processes. It is certain that the future of the gas industry depends largely upon its industrial load, which is steadily growing. As I have been associated with the supply of gas-making plant for individual uses, and also with the first large central station for the distribution of low-grade gas for industrial purposes, and these connections have in the past been regarded as competitive with the town gas interests, I should like to think that, if there is any significance in my presence here, it is an evidence of an *entente cordiale* having been established between Mond gas and town gas.

### MOND GAS.

Moreover, you will perhaps pardon me if I indulge in some personal reminiscences in connection with gas. It is exactly a quarter-of-a-century since the Mond Gas Bill was successfully piloted through a Select Committee of the House of Commons, which concluded its deliberations on May 10, 1901. It is interesting to look back over twenty-five years, and remember the very determined opposition which that new and difficult enterprise met with from the gas undertakings. In the area covered by the Bill were the city and towns of Birmingham, Walsall, West Bromwich, Handsworth, Stourbridge, Bilston, Wolverhampton, and Dudley. All these sent some eighteen learned Counsel and witnesses to try to prove the impracticability of the scheme, and to guard their monopoly rights. There were, of course, distinguished advocates and witnesses on behalf of the process—including such men as Lord Kelvin, Prof. James Dewar, Sir Frederick Bramwell, Prof. Richard Threlfall, &c.—and the Bill received the Royal Assent on Aug. 9, 1901, after very costly and difficult proceedings.

I may be forgiven if I say that this enterprise was not one of the kind which are undertaken from any great hopes of personal gain; and the history of the South Staffordshire Mond Gas Company is sufficient evidence to show that whatever hopes may have been cherished, they have not been realized by the promoters. I do, however, think that my late father, who gave this scheme a good deal of personal and financial support, has vindicated his foresight so far as the technical and engineering aspects of the scheme are concerned, and that the forebodings of the opposition were not justified. For twenty-six years the Mond gas plant in South Staffordshire has been distributing, without interruption day or night, many millions of cubic feet of gas per day. This gas has been produced without storage, in units of plant—the make being immediately adjusted to the demand, from a few thousand cubic feet to millions per hour, of even quality with recovery of valuable bye-products—and has been distributed through 45 miles of pipes laid in an area honeycombed with colliery workings. It is serving over 150 different customers with a cheap and efficient gas.

I therefore think that, from the industrial point of view, it is an illustration of an attempt to meet the national need from which something could be learned and developed in the light of experience and modern knowledge. The Company has, of course, laboured under very restricted conditions, and for most of its lifetime has been limited as to CO content in the gas, and as to charges for supply; while the gas was not to be used for illuminating purposes or supplied to gas undertakings for such use. Recently, however, some of these restrictions have been removed, and the Company is free to develop on lines which will enable it to take advantage of, and perhaps assist in some little degree in, industrial revival.

My object in referring to this is to suggest that, at a time when electricity is being made a national affair, there would seem to be need also for the breaking-down of barriers which restrict the development of the gas industry. These barriers are partly due to the method in which the production and distribution of gas have developed—namely, within the town areas. The line of development has been the immediate domestic supply, and industrial requirements have been generally a secondary consideration. Indeed, in many towns there is a jealousy lest the industrial user should get gas cheaper than the private

consumer. Then there is a sense of rivalry between township and township, each carefully guarding its own entrenched position. Again, the gas industry since its inception has been tied down to the necessity of distributing a rich quality of gas, which can be taken through one system of mains for domestic and industrial purposes alike. This system of mains in many towns was laid down by our forefathers, and it compels the use of a richer quality of gas than economy and necessity demand. Still further comes the question of the huge capital cost which has been invested in gas undertakings, and which generally adds a heavy burden to the supply of gas.

### Looking Ahead.

Looking ahead, it seems that the hopes of the gas industry are in the development of its industrial load, and in the use of gas for domestic cooking and heating, for which it still holds the field. If the present demand for cleaner towns and greater efficiency in the use of coal is to be met, I think the gas interests ought to adopt a wider policy. The present system of gas production involves the transport of very large quantities of coal into the towns, and the production of a relatively small quantity of gas and a solid residue of carbon in the form of coke, which has either to be sold or to be converted into gas again through water gas plant. I venture to suggest that very considerable economies in capital cost and working cost could be made by modernizing (on lines which have already been to some extent worked out) the systems of gas production and distribution to which I have alluded. By these methods it is possible not only to convert coal cheaply into gas for industrial and domestic heating purposes, but at the same time to conserve for national use a large quantity of valuable oils and bye-products. The direct system of cooling, cleaning, and treating bye-products which has been developed during the past twenty-five years could, I think, be more widely adopted in connection with town gas, and lead to a great saving in capital outlay.

The distribution of lower-grade gas over wide areas is being carried out on a big scale in other countries than our own. In these cases, some of the gas making plants are situated in the coal areas. The subject of the production of electricity at the collieries has been before the Coal Commission; and the well-known objection which was lodged against the putting-down of super-electric stations at collieries was that an ample water supply for condensing purposes was essential to any site selected. Such sites were as a rule not available at collieries. This objection, however, does not apply to a well-considered arrangement of gas generating plant and gas engines; and this combination would afford an opportunity for gas and electricity to be generated together, and made complementary to each other. Where gas was produced at collieries, much better use might be made of waste or inferior fuel which cannot be utilized conveniently for gas production, owing to transport costs. The gas generated could be distributed to the town centres under high pressure, and both gas and electricity could be distributed through the authorized undertakers.

### Lines of Development.

When considering the present coal position, it is comforting to believe that there is no finality in modern industrial progress—not even within the coal industry! New processes may be discovered which temporarily supersede a particular basic raw material; but research provides new commercial uses for these basic raw materials, the resilience of which again gives them the supremacy. Coal has had a huge check by competition with oil and electricity, and just as at one time the gas industry was threatened by electricity, and just as electricity has failed to oust gas from its place of pride for either industrial or domestic uses, the competition of neither oil nor electricity will, in my opinion, prove fatal or final to the coal industry. With up-to-date steam plants working on most modern lines with powdered fuels, electricity can be produced at a very low figure in this country, and compares favourably with most water-power plant that I know of.

The large gas engine has been somewhat under a cloud. Its development has been disappointing, and therefore it is a very interesting fact that at the Staveley Company's works at Chesterfield they have recently installed a Cockerill gas engine and alternator of 7000 H.P. (5000 KW.) working on blast furnace gas. It is the biggest gas engine put down in this country, and two more of a similar type are now being built for the same Company. The installation costs less than a modern steam turbine electric plant, and is much more efficient. This shows that the big gas engine is by no means out of the running in the race which is being carried on for cheaper power production. Like all the different methods, we are still waiting for the development of the gas turbine, a problem which has received the study of so many engineers, and the practical solution of which still seems not yet reached. Is it too much to hope that the great difficulties in finding materials to withstand the temperature required can now be overcome by the use of a new series of high-grade nickel-chrome alloys, which have formed the subject of much research during the past year? If so, we may see a new orientation of power production.

Steam, oil, gas, powdered fuel, and different types of boilers, producers, and other forms of generators, are carrying on a continuous race for supremacy. Every step forward means the lowering of power costs, and consequently cheaper production of commodities in the future. Scientists of all countries know that the end of this race is not to be foreseen, and many of the questions are still in their infancy. It is the knowledge of these forms of progress growing throughout all industries which makes me an optimist, not a pessimist, even at a time when the industrial position is one of temporary paralysis. The economic difficulties of the Napoleonic era, with its great struggle, were solved by industrial progress, due to steam. It is by the better utilization of coal in the various directions I have indicated that we must solve the economic legacy of debt and high taxation left us by the great war. I feel convinced that this is being achieved; and if we could only have industrial peace instead of unrest, a wider outlook by those concerned in industry and finance, we could create a new period of progress and prosperity. This alone will enable us, not only to maintain, but to increase, the standard of living of our population, to produce the high wages with efficiency for which there is such a demand, and to support the population which is ever growing.

Those hearers of my address to-day must share, in their various industries, the greater industrial activities of the future. I leave my year of office as President of this important Society—a post I feel much honoured to have been allowed to hold—with a sincere hope and conviction for a better time to come for all its members.

### Vote of Thanks to the President.

Mr. R. B. Hodgson proposed a hearty vote of thanks to Sir Alfred Mond for his address and for the services he had rendered the Society during his year of office. An address like the one they had listened to called for their highest praise and for their gratitude; and he ventured to assert that it could have been delivered only by a man of such outstanding attainments as their President. Sir Alfred had brought to bear upon the subjects with which he had dealt his manifold experiences of industry, politics, and economics. Associated with many of the largest industries—coal, steel, iron, and chemicals—he applied to each a commercial and technical knowledge second to none in the country; and they were delighted to have him as their President. He was a busy man, and they appreciated all the time and help he had given them. They congratulated him warmly on the position he held both as a statesman and as a leader of industry. In each of these directions he had made for himself a name which was honoured and respected by all; and they trusted that out of the store-house of his wisdom he might assist towards a solution of the complicated problems by which they were faced. As to their own Society, it was an important one. The membership, as had already been stated, was 136, and included many of the largest gas engineering businesses in the country. The capital involved in these businesses ran into many millions of pounds, and tens of thousands of workmen were employed in them. Those present should therefore be proud of the Society they represented.

Mr. B. B. Waller, seconding, said the address was an illuminating and inspiring one. The words of wisdom Sir Alfred had given them at their autumn meeting led them to expect much that day, and they had not been disappointed. It was a source of great satisfaction to know that Sir Alfred would not be leaving them when he vacated the Presidential Chair, but that he would become one of their Vice-Presidents, so that they might hope to have both his company and his help on future occasions. Industry was, of course, under a cloud at the present time; but they all trusted that the coal trouble might terminate at an early date. When it did come to an end, he thought they would be able to remember Sir Alfred Mond as having been largely responsible for bringing about a settlement.

The vote having been carried by acclamation,

Sir Alfred Mond said he had to thank his old friend Mr. Hodgson for the kind manner in which he had proposed it. He and Mr. Hodgson had been associated for a number of years in Messrs. Ashmore, Benson, Pease, & Co.; and he had always entertained a high opinion of the value of the services Mr. Hodgson then rendered. He had for him a very warm regard. He also wanted to thank Mr. Waller for his kind words, and the members for the way in which they had received the motion. He was afraid he had not been able to render the great services he would have liked to give; but he would always look back with pleasure on his Presidency, and hoped that as Vice-President he might still be able to do something for so important a body as the Society of British Gas Industries.

### The New President.

The President then, amid applause, inducted to the chair the new President, Viscount Ednam, M.C.

Viscount Ednam said that after the splendid address to which they had just listened from Sir Alfred Mond, any further remarks on his part must appear redundant; and therefore he only wanted to take this opportunity of thanking the members from the bottom of his heart for the great honour which they had done him in electing him President of so important a Society for the coming year, and to assure them that he was deeply sensible of this honour. When he realized that he was following a man so distinguished and of such outstanding ability and experience as Sir Alfred, and when he looked down the list of prominent Past Presidents, he saw clearly the responsibilities which he had to undertake, and was very cognizant of his own unworthiness to hold this position. As a matter of fact, he

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learned that he was the youngest President they had ever elected. He hoped, therefore, they would not find him wanting. As a coal owner, he was deeply interested in gas in its raw state; and as Chairman of a steel works he was as deeply interested in manufactured gas for industrial purposes. As a South Staffordshire man he was also interested in the South Staffordshire Mond Gas Company. He was on rather delicate ground here, because he was not sure whether his predecessors were among the many witnesses who gave evidence against the scheme 25 years ago. [Laughter.] But at any rate, he would like to take this opportunity of paying tribute to the great work that Company had done during the past quarter of a century. Again, as a coal owner, he did feel that during this crisis they were fortunate in having a man of the experience of Sir Alfred Mond, and with his commonsense, working to find a solution of their difficulties. Reference had been made in the address to Sir Alfred's selling agency scheme. In his (the speaker's) coal district they had been studying the scheme during the past fortnight; and he could bear out personally, so far as that district was concerned, Sir Alfred's assertion that the scheme was being most sympathetically received by the coal owners.

### M'EWEN-RUNGE LOW-TEMPERATURE CARBONIZATION SYSTEM.

He was pleased that, owing to the strike—it was an ill-wind that blew nobody any good—the meeting of the Society had had to be postponed. If it had taken place on the date originally fixed, he would have been unable to be with them, as he had been over in America for two months. He went over there primarily to study a process of low-temperature carbonization which he had been watching with some interest during the last two years. This particular process was an English invention, by Mr. McEwen, who tried to get it taken up in this country, and failed. He then took it over to America, and collaborated with Dr. Runge. It was financed by Americans, who had had experimental retorts in action during the past two years. A full-sized plant had just been erected at the works of the Milwaukee Electric Railway and Light Company. The process had been proved; and he was perfectly certain that it would be to a large extent the salvation of the coal industries in this country. An endeavour was made a year ago to get the process taken up under the Trades Facilities Act; but this effort was unsuccessful, and so it had been left to the Americans to finance the scheme. The Milwaukee people took it up at once. They foresaw something which, if successful, would mean cheaper electricity. They put down their capital, and the step had been fully justified.*

### EIGHT-HOUR DAY.

He hoped that before many weeks were over they would be through with their difficulties in the coal industry. He thought the group of collieries of which he was Chairman was one of the first—if not the first—to post notices for the April rates for an eight-hour day. Last week they had one of their areas going very nearly at full blast; and they had signed on a very large number of men on the eight-hour day. There was no doubt the men wanted to come back on the eight-hour day; but he was sorry to say at the present moment, owing to intimidation which was being carried out all through that district, very few of these men were able to come to work. It was sad to think that these fellows were not even allowed the right to work. He promised during his year of office to try to make himself thoroughly acquainted with every detail of the aims and objects of the Society; and he undertook to do everything in his power to further its interests.

## ANNUAL DINNER.

In the evening the members, with many well-known guests, met again in the Hotel Cecil, where the annual dinner took place. With speech and music, fitting celebration was made of the twenty-first anniversary of the Society; and those responsible for the arrangements are to be congratulated. For the programme of music, it may be mentioned, Miss Millicent Russell was responsible. On the menu were to be found portraits (which we reproduce) of past and present officers of the Society, and the following interesting statement.

> The inception of the Society may be traced to an article in the "GAS JOURNAL" in December, 1904, by the present Editor, Mr. Arthur F. Bezant, in which he called attention to the desirability of forming an Institution of Gas Plant Apparatus Makers.
>
> Mr. Charles Clare enthusiastically acted upon the suggestion, and called together a number of manufacturers at the close of the Earl's Court Gas Exhibition. The outcome of that meeting was the formation of this Society, and the first meeting was held in March, 1906, under his able Chairmanship, since when he has always rendered signal service.
>
> At the same time, Mr. Arthur L. Griffith was appointed permanent Secretary. His assiduous interest in the affairs of the Society, and unfailing courtesy at all times, have in no small degree promoted its success.
>
> At the meeting in November, 1906, the Society was honoured by Sir Dugald Clerk accepting the first Presidency. He has always taken the greatest interest in its work and rendered valuable service.
>
> Starting with a membership of 36 firms, the present roll is 136.

COMING-OF-AGE DINNER OF THE "S.B.G.I."

* Brief references to this system will be found in the issues of the "JOURNAL" for Sept. 16, 1925, p. 676, and June 9, 1926, p. 542.

It is estimated that the capital represented by them amounts to over 30 millions, finding employment for many thousands.

The aims of the Society are primarily the advancement of the gas industry by research, investigation, and the maintenance of a high standard of production, and the promotion of a spirit of co-operation and loyalty amongst the members, extended to allied kindred Associations.

The registered trade mark available to all members may be taken by buyers throughout the world to stand as a guarantee or hall-mark of excellence.

The Society refers with just pride to the list of Past Presidents, embracing so many distinguished names. Their addresses form a valuable addition to its records. It is fortunate in having in the Chair as its President to-day such a prominent leader of industry as Sir Alfred Mond.

The Society remembers with gratitude the great services rendered by Past Presidents who have passed away—Sir George Livesey, Mr. Thomas Newbigging, Mr. Balfour Browne, Sir Corbet Woodall, and Lord Moulton, names well known and so highly esteemed in the gas industry.

With steadfast endeavour and unity of purpose, the Society looks forward with confidence to the future.

The President (the Right Hon. Sir Alfred Mond, Bart., M.P.) was in the chair; and on his left hand there sat the Right Hon. Lord Aberconway, P.C., Sir Dugald Clerk, K.B.E., F.R.S., D.Sc., LL.D., Mr. D. Milne Watson, D.L., Viscount Ednam, M.C., Alderman F. J. West, C.B.E., J.P., M.I.Mech.E., Mr. Thomas Glover, C.B.E., J.P., M.Inst.C.E. (Lord Mayor of Norwich), Mr. Charles F. Botley, M.Inst.C.E., Mr. Charles Clare, Mr. William Cash, F.C.A., Mr. Frank H. Jones, M.Inst.C.E., Mr. Thomas Hardie, M.Inst.C.E., Mr. J. W. Broadhead, M.I.Mech.E., Prof. John W. Cobb, C.B.E., B.Sc., F.I.C., and Alderman George Clark, J.P., M.I.Mech.E. To the right hand of the President there were: The Right. Hon. Viscount Haldane, K.T., P.C., O.M., Prof. Arthur Smithells, C.M.G., F.R.S., D.Sc., Mr. B. B. Waller, A.M.Inst.C.E., Mr. Reginald G. Clarry, M.P., Col. J. F. T. Blyth, C.M.G., LL.D., Mr. Samuel Cutler, A.M.Inst.C.E., M.I.Mech.E., Mr. W. E. Price, A.M.Inst.C.E., Mr. Douglas H. Helps, M.Inst.C.E., Mr. Frederick J. Gould, Mr. F. W. Goodenough, C.B.E., Mr. Frederick C. Tilley, M.I.Mech.E., and Mr. W. D. Helps.

The toast of "The King" having been honoured,

### No Better Investment than Gas.

The Right Hon. Lord Aberconway said he esteemed it a great honour to have been invited to this banquet, and still more so because he was face to face with a body of men who had devoted themselves to so large an extent to the public service. Here were present not only those who produced gas, but also those who had given their attention to the production of every kind of scientific appliance which enabled the gas to be utilized to the best advantage. Although gas might be no longer the chief medium for the lighting of houses and streets, there was no doubt it was going to be the medium for heating and cooking, and to a certain extent for the creation of power; and though he was not the happy holder of gas shares, he should say there was no better investment to-day than property in gas. He was a sort of "poor relation" of the gas industry, because he had spent a good deal of his time in providing that industry with the raw material out of which those engaged in it made their fortunes. He was an unfortunate coal owner; and although he considered his gas coal second to none, he found a strong indisposition on the part of the gentlemen who ran the gas-works to give him a price which was better than about 28. a ton below what it cost him to produce. [Laughter.] "You," said Lord Aberconway, "bask in the sunshine of public approval; I spend my days in fighting Mr. Cook. You can imagine that when one has to face angry shareholders at colliery meetings, who ask why they are not getting dividends, it is not easy to tell them that we cannot sell our material at the price we ought to get; and we have to face Mr. Cook and his friends, who insist on having wages which the industry cannot pay. That is our unfortunate position." Continuing, he said that the appliances which the members of that Society produced, and of which the public eagerly availed themselves, were evidence that an industry which was once considered doomed was perhaps now more flourishing than ever it was before. The scientific mind had turned its efforts in the direction of overcoming difficulties, and of creating prosperity out of what appeared at one time to be the reverse. They had determined that electricity should not supersede gas for all purposes; and it was another illustration of how a national industry which appeared to be in a decadent condition, if it got into the hands of men of energy and men of science, would rise from its ashes, and even be numbered among the most prosperous industries in the land. He was perfectly certain that those who carried on industries which the public must have, and which were of enormous service to the domestic life of the country, would never fail those who depended upon them. Possibly the gas industry feared the Electricity Bill of the Government. Well, he had studied it, and he could not say he liked it, because he was afraid that, having these great centres of electricity production run not always by men who understood the commercial side, but by municipalities and other perhaps even less competent people, the scheme might not altogether prove a success. But whatever was the fate of that measure, he hoped it would help the coal trade, which he represented there that night. Some people would tell them that the days of coal were done; but he did not believe it. The history of the world showed there were certain things which once having established themselves always retained their value; and having regard to the enormous advantages to this country which its mineral resources offered, he hoped nothing would ever be done which would diminish the power of the collieries to produce coal at a price at which they could sell it abroad. The exports of coal were the salvation of this country. It was through them that the food supplies from abroad were obtained. He trusted those who were interested in the production of gas would always remember that, although they made enormous profits which were restrained by Act of Parliament, there were unfortunate coal owners who wanted to make profits without any restraint; and they could help them to do so. [Laughter.] It was his pleasure to couple with the toast the name of the President. Sir Alfred Mond was a man whose name was known in every part of the country. He was one of their great leaders of industry—and more than that. He had the greatest admiration for Sir Alfred, and believed that if he applied his mind to some of the industrial difficulties from which they suffered, the country would be a great gainer.

### Times of Progress for the Industry.

The President, responding, said any terms of praise coming from one whom they might fairly deem the Nestor of the British coal and steel industries must be very gratifying to a younger man like himself. He had to respond for a Society which had now had twenty-one years of existence, and so had come of age, and was no longer an infant irresponsible for its debts or other acts. [Laughter.] The Society was therefore entering on a more serious stage, and his successor in this honoured position would assume a responsibility which he himself had fortunately escaped. A Society with such a record as theirs would doubtless survive for a great many years to come. As the last speaker had pointed out, the gas industry was not in a moribund condition—fortunately for those who supplied it with all that it required for its existence. He happened himself, among other things, to be one of those who were interested in the production of gasholders, retorts, valves, gas producers, coke ovens, or any other job of a like character that might come along. Unfortunately, like the coal industry, the gas engineering trade—whatever the gas companies might be doing—was not in any too flourishing a condition. The gas industry was equally unwilling to pay an adequate price to those who supplied it with plant as it was to the coal owners. [Laughter.] It was quite true that the gas industry, as he had stated that afternoon, had a big and interesting future—possibly a varying and different future from the past. It was difficult now to imagine what the world was like without gas. He remembered his father telling him, however, that when he first came to England he saw some of the earliest gas lights in London.

### Changing Methods.

At the present day the idea of gas as a novelty was quite unthinkable; but many changes had taken place since the industry came into existence, and such changes were bound to continue. Methods of making gas, its composition, and its uses must all vary from time to time. There was a large amount of change and development going on all over the world. A friend had informed him that in Westphalia there was scarcely a gas plant of the old type to be found. Domestic gas was derived from coke ovens—probably, he should think, enriched with some stronger form of gas. The President of a prosperous combination in America controlling one of the largest coke oven businesses in that country had stated that the practice there now was not to put up coke ovens and steel works at collieries, but to erect them in towns, so as to supply gas for household purposes and sell coke as domestic fuel. This gentleman, in fact, sold a million tons of coke for that purpose alone in a relatively small part of the country. This was the sort of change that was taking place. Discussing the Smoke Abatement Bill in the House of Commons on the previous day, some members complained that domestic smoke was being left entirely untouched. Everybody knew that the much-abused factory chimney was capable of improvement; but it was by no means the only or the greatest sinner in creating the smoke cloud which was injurious alike to health and to buildings. Until the domestic smoke question was effectually tackled, they would never get that improvement in the atmosphere of towns which sanitation and humanity demanded. It was therefore rather disappointing that the Minister of Health would not agree to give local authorities power, even as regards new buildings, to make bye-laws to compel the putting in of smoke-reducing arrangements. It was a mistake to be so timid on the subject. Heat was available in forms which did not give rise to grimy soot. The question of a clean atmosphere was of importance to the Society, because it involved an increased consumption of gas as a fuel. If they could only get it cheap enough, it would make a very great difference. The gas industry had been relieved of some of its old shackles, after a great struggle; but further elasticity still would be required, for the advance of science was much more rapid than the advance of legislation.

### Faith in the Future.

It was, he thought, on the lines he had indicated that progress must ultimately come; and the Society would do much to further it if they were ready to apply the abilities they possessed, individually and collectively, in assisting the engineers of gas undertakings to improve and to modify their works and their practice. He would like to say how glad they were to have with them that night the first President of the Society, Sir Dugald Clerk. ["Hear, hear."] He had had the pleasure of knowing for a great many years Sir Dugald Clerk, who had the property of eternal youth. Whether this was due to his connection with the gas industry, he (the speaker) did not know. The Society had also had many other distinguished Presidents whose names were familiar to them all. He could assure the proposer of the toast, in the name of the Society, that they were sanguine that, far from having passed their zenith, they had not yet really started on their career, either as an industry or as a country. He had a great and absolute faith in the future of Great Britain; and he had

a still greater belief in the future of the British Empire. All the qualities which had made them great in the past remained with them to-day. With the removal of their present troubles, and the coming of a happy peace, they would again find themselves on an upward trend. If they considered the devastating effects of the great war, it was not so remarkable that they were passing through difficult days as that they had already recovered so well. When one compared the condition of Britain to-day with its condition after the Napoleonic wars, they had no reason to be discouraged. They were holding their own, and would continue to hold their own, in the markets of the world.

### A Golf Challenge Cup.

At the conclusion of his speech, the President said he had the pleasant duty to perform of handing a Challenge Cup to Mr. Eric J. Davison, who had been bold enough to defeat that terrible person Col. Bogey by no less than five up. He hoped Mr. Davison would retain the cup for many years to come. [Applause.]

Mr. DAVISON, in acknowledgment, expressed the hope that on future occasions there would be a greater number of competitors.

### The Gas Industry and Science:

Prof. ARTHUR SMITHELLS said that in the regretted absence of Sir Arthur Duckham he had been asked at short notice to propose the toast of "The Gas Industry." He could not give them the speech that Sir Arthur would have given them—the speech of a man leading industry, who was keenly alive to the difficulties of the industrial situation—but he had had a long connection with the gas industry, and would not admit to being inferior to Sir Arthur in the interest he took in this great industry. He remembered the mid-Victorian days, when the gas industry semed to be in a condition of repose, and when, to tell the truth, it seemed to have a dull and uneventful existence. He remembered the days when it was first threatened by electricity. He remembered specially well, and with particular pleasure, the days when the new hope arose from the work done by his old fellow-student Auer von Welsbach in the laboratory of their teacher Bunsen. Later on he became more closely associated with the industry, when he was invited to talk about scientific matters of some concern to it, and from that day to this his interest in it had been maintained. It was wonderful to consider the progress of this industry. On the previous day he was talking to the grandson of William Murdoch, a man younger in years than himself; and it made him realize more than he had ever done before how really young the industry was. When he thought of what the industry had accomplished in its life, he could only say that he agreed most heartily with all that had been said in praise of it by the President. Of all the features of development in recent times, the one that had been most gratifying to him was the closer approach the industry had made to the sciences connected with it, and which must be intimately bound up with its future prosperity. Every one present knew of the liberality and enterprise shown in founding the Chair in the Department of Leeds University with which he had so long been connected. The industry had still a great way to go, and a great deal to do; and he entertained not the slightest doubt of its continued and increasing prosperity. It was of the first importance to this country that it should have the right men leading such industries as this; and he emphasized this, because it gave him peculiar pleasure to associate with the toast the name of his old friend the Governor of the Gas Light and Coke Company. In Mr. Milne Watson they had a leader who possessed the confidence of every branch of the profession.

### Gas Industry's Need for Freedom to Develop.

Mr. D. MILNE WATSON expressed his thanks for the way in which this toast had been proposed and received by so distinguished a gathering. The industry for which he had the honour to reply had had a very long career, dating back to 1812, when the Chartered Gas Light and Coke Company was founded under a charter of George III. It had been in existence now for 114 years; and it was the proud boast of those connected with it that it had never gone back. Lord Aberconway had suggested that street lighting had passed away from gas. To a certain extent it had; but many of the streets first lighted by gas in 1812 in London were still so lighted. For instance, he might quote Pall Mall and St. James' Street. This showed, at any rate, that gas had had a long and useful career, even in lighting. The gas industry had during the last year or two been going through a very difficult and strenuous time. There had been continual competition, not only by electricity, but by oil and other new forms of energy; and they had met all this to the best of their ability. Recently one of their chief difficulties had been what Lord Aberconway had referred to as the low price of coal, but what the gas industry considered the very high price of coal and materials generally, combined with diminished returns from residuals; and altogether their lot had been not at all a happy one. Not only had they had to meet all this, but they had had in addition to face a great Government campaign in favour of electricity. At the same time, though they had in electricity a very formidable competitor—especially when backed up, as it had been, by politicians and in the Press—and though they had had their moments of fear and trembling, they were not without hope for the future. ["Hear, hear."] If they used their opportunities aright, he felt sure that the Electricity Bill which was now before Parliament would not be an unmixed evil for the gas industry. It would not be an unmixed evil if they took to heart the lessons it taught—if it made them put their own house in order—and if the Government consented to free them from some of the trammels in which the gas industry at present carried out its work. It was in the power of the Government to do this, and he hoped they would. The gas industry did not ask for freedom to do anything it liked, but it did want freedom to develop on truly modern lines. If it was enabled to do this, he was certain it would go forward and continue to do great service for the country. This was essentially a coal country, and nothing could get away from that; and however useful electricity might be, and however much it was desirable that they should have a good and cheap supply of electricity, the proper way, generally speaking, to use their coal was in the form of gas. By this means the country undoubtedly conserved coal, because a far greater proportion of the heat units contained in the coal were usefully applied in the form of gas than as electricity. Therefore if the gas industry used its opportunities properly, he was perfectly certain that it had a great future before it. The industry had in the past associated itself with science through its relationship with the Leeds University, and in other directions; and this course it was proposed to continue to pursue with unabated vigour. They were also indebted on the practical side for a great deal of knowledge to their connection with the Society of British Gas Industries. Without the members of the Society and their plant, it would be impossible to make gas satisfactorily; and so he trusted that the relationship between the gas industry proper and this body of manufacturers would remain, as it had been, of a very cordial nature. The gas industry had an honourable tradition behind it. It stood very high among the industries of the country; and if they realized their heritage, and worked hard, and did the best they could for the public, the industry would have nothing to fear for the future.

### Co-Partnership in the Gas Industry.

Mr. REGINALD G. CLARRY, M.P., who also responded, said he was glad of this opportunity of definitely associating himself with the gas industry, in which he was proud to have been brought up. There was at the present moment a great cloud hanging over the country, caused by the coal strike; and it was refreshing to him to be associated with an industry which seemed to be more or less free from the epidemic of labour troubles. This immunity had been very largely brought about, he believed, by the care and interest which owners and managers, and others who were looking after the men, took in the welfare of the employees—particularly in connection with the co-partnership development. He did not suppose there was another industry in which co-partnership had been developed to the same extent as had been the case in the gas industry; and there could certainly be but few industries which had suffered less from labour disputes. He had been glad to learn recently that some of the members of the Society connected with the manufacture of meters had made the wise decision that co-operation was better than suicide—that it was better to be alive than dead. By supplying meters they were rendering a service to the public; and if they did not live to make the meters themselves, it would mean that they would have to be furnished by somebody else—it might be from a foreign source. The gas industry was of very great value to the country. When he went into the House of Commons for the first time, four years ago, it was probable that one would have been able to count the advocates of gas on the fingers of one hand. This was not the position to-day; and the change had been brought about largely by the very excellent propaganda work and other activities of the British Commercial Gas Association, and also by their friend Mr. Milne Watson, who had spared himself in no degree whatever to bring the claims of the gas industry to the attention of politicians, who should really in the first instance have found out all about the matter for themselves. As to the Electricity Bill, this was making slow progress. There had been twenty sittings in Committee, and they had reached clause 6, out of 32. Their sympathies should go out to the electrical industry; might the gas industry never suffer the same! If this Bill became law—as he believed there was a reasonable chance of its doing—it should give them no cause to fear unfair competition, for they had the assurance now of the Attorney-General that he was very glad to hear the gas industry would co-operate in this electrical development over the country. Frankly, the only chance he (Mr. Clarry) saw of consumers in this country getting a cheaper supply of electricity was in those areas where gas co-operated and furnished the current itself. He thought this had been gradually borne in upon the Government, so that they would hear little more of this extravagant boosting of their young sister the electrical industry. The Government were appreciating more than they had previously done the value of the gas industry in connection with the conservation of coal. Another thing which was being borne in upon those in authority was that the only places in the country to deal with low-temperature carbonization were the existing gas-works. "If," concluded Mr. Clarry, "you (who are such a valuable accessory to the gas industry) and the gas industry itself (which has always been renowned for its enterprise) continue in the course you have adopted in the past, and co-operate together, and retain confidence in and respect for each other, it will augur well for the continuance of a public service of which there is no equal in any country of the world."

### "Our Guests."

Alderman FRED. J. WEST, proposing "Our Guests," remarked that the Society esteemed it a great compliment that Lord Haldane, whose name he coupled with the toast, should have honoured them with his presence that evening. They were greatly encouraged in their endeavours as a Society to assist in solving the great problems confronting the gas industry, by having with them at that dinner so many distinguished gentlemen connected with the industry; and to them they extended a very hearty welcome.

### Looking Forward—

The Right Hon. Viscount HALDANE offered the grateful thanks of the guests for the honour that had been done them in inviting them to the celebration of the twenty-first anniversary of the Society. He said that two things had struck him in the course of the speeches with which he agreed. The first was a very simple cause of agreement—that was to say, the utterances of the speakers had been of an optimistic character as regards the future of the gas industry. The second point was the future of this country. There had been a great growth of university education; and this meant that they were sending into the industries and into public life a much larger number than ever before of those who were highly trained, because the universities had gone ahead, and had realized that it was part of their duty to be in touch with the life of the nation, and to inspire it. He

had no doubt as to the future of this country, if only they maintained the spirit which had manifested itself in the past. For thirty years he had been clamouring for the development of electricity in this country; and now he saw it going ahead with a force which seemed to him irresistible. He had little doubt that the Government Bill would pass; and it ought to give them a plentiful supply of cheap electricity. Would this injure the gas industry? He had lately had a visit from Mr. Samuel Insull, of Chicago, who had told him that, although he had devoted himself to electricity, not less had he devoted himself to gas, with the result that in Chicago he was obtaining an increase in the consumption of gas not less great than the increase in the consumption of electricity. The truth was that what was wanted in this country more than anything else was cheap power and energy. They wanted to put at the disposal of their highly-trained workmen the means of turning out a great deal more work than they were able to do under the old conditions. For this they needed both gas and electricity. He had great confidence in the future of the gas industry, and for the same reason that he had in the future of the country—because new talent, new knowledge, and the same old spirit were being applied to it. He knew Germany well; and before the war he was very much alarmed, not because of the military preparations, but because of the marvellous capacity for organization and for the application of science with which he had day by day come in contact there. To-day, however, this country had solved that problem to a very great extent; and he did not believe at this moment that there was proportionately more, or finer, science in Germany than in this country. The universities and the students were just as good; and the manufacturers were waking up to the importance of organization, and to the need for new ideas.

### And Looking Back.

Sir DUGALD CLERK, submitting the toast of "Our Founder," referred to the origin of the Society. In 1904, he said, Mr. Arthur Bezant, who was with them that night, wrote in the "GAS JOURNAL" a series of articles upon the necessity for the formation of such a Society as theirs, as complementary to the Institution of Gas Engineers. Mr. Charles Clare at once took up the idea, and after hard work got together a Council, of which he (Mr. Clare) was made Chairman. Upon Mr. Clare fell the first heavy work of organizing the Society. The task was begun in 1905—twenty-one years ago. At the end of 1906 Mr. Clare, with their Secretary, Mr. Griffith, called upon him (the speaker), and asked him to become the first President. He pointed out that, though he certainly had been associated with gas, he was only a manufacturer of plant in connection with internal combustion engines, and that it would be more appropriate to have (say) a retort or gasholder manufacturer than a gas engine man. Mr. Clare, however, told him that they had had many technical objects in forming the Society. They desired to have a Society the members of which could meet at intervals and discuss all the matters, scientific and industrial, concerning gas-plant makers. At the same time, they wished to co-operate in a friendly way with the other side of the industry; so that the whole of the affairs of the gas industry could be dealt with by the two organizations in amicable relationship. It was felt that, so long as the manufacturers of gas plant and apparatus had no Society of their own, it was not so easy for them to approach the other Institution so as to discuss with them problems of general interest. In the circumstances it was thought better that one who was known to both sides should be the first President; and they asked him, as he had to do with the gas engineers as well as with the members of that Society, if he would take the chair. ["Hear, hear."] The Society was a success from the beginning. A circular was issued in March, 1905, and the first meeting was held on Nov. 23, 1906. On that occasion Mr. Thomas, the well-known architect, gave a highly-interesting paper on the uses of gas from the architectural point of view. There was a dinner in the evening which was very successful; they had the pleasure of having on one side of the President his old friend Mr. Charles Hunt, then President of the Institution of Gas Engineers. ["Hear, hear."] There were also present a great many other gas engineers; and they all became far more friendly with each other than would otherwise have been the case. After all, there was no great distinction between the engineers of the gas-works and the engineers engaged in manufacturing plant. The meeting at which his Presidential Address was given was in February, 1907; and on that occasion his address was on "Patent Law Reform." They were all much concerned with the patent law at that time; and he gave a list of things that it was desirable should be inserted in any altered patent law. He was glad to say that after a few years this came about, and that every one of those things was in the patent laws of England as existing to-day. So the Society had effected something right from the start. On looking back, he found that, for some reason or other, he gave a second Presidential Address in November, 1907. This was on "Science and Practice;" and in it he spoke so plainly that some members of the electrical industry said that he had turned round and beaten his flock. This, however, was not what he had done. After that meeting, they were successful in getting Sir George Livesey, a very distinguished gas engineer, to take on the Presidency; and his address was a most inspiring one. The Council remained under Mr. Clare for four years; and his good work, with that of the men around him, elevated the Society to a very high point. Nothing now that occurred in the world of gas could be dealt with fully unless the Society of British Gas Industries were concerned as well as the other bodies. All this was a great triumph for the founder, Mr. Clare, who well deserved any praise they could give him. [Applause.]

### "Our Founder."

Mr. CHARLES CLARE, on rising to respond, declared that the reason why, at the beginning of the Society, they had asked Sir Dugald Clerk to give two Presidential Addresses was that they felt they could not have too much of a good thing. ["Hear, hear."] It was a very great pleasure to him that this toast had been entrusted to Sir Dugald Clerk, their first President. At that time it was essential that they should have a man of distinction, and one who, by his help and advice, could give the Society a good send-off. Sir Dugald Clerk had always done his best for them, and it was really a splendid thing to have induced him to lead off that long line of distinguished Presidents. There was one curious coincidence about their Presidents, and this was that as soon as they had passed the Presidential Chair they had some honour bestowed upon them. He sometimes wondered what was going to happen to Sir Alfred Mond. They had honoured him (Mr. Clare) by toasting him as the founder; but as a matter of fact he was simply the instrument by which the Society was set afloat. The "GAS JOURNAL," backed up by several of the exhibitors at the old Earl's Court Exhibition of 1904, expressed a strong view that such a Society should be formed; and he was deeply indebted to Mr. Bezant, not only for his advice and counsel in those early days as regards the preliminaries of the Society, but also for his introduction to Sir Dugald Clerk. Then he also owed a deep debt of gratitude to his first Council, two of whom he was glad to say were present—Alderman Fred J. West, and Mr. J. W. Broadhead. Their advice and encouragement helped considerably in what were most difficult times. And he must not, of course, forget their Secretary, who had done so much for them through all this time. The Society in its early days was called "Clare's baby;" and now that it had reached its twenty-first birthday, he could say that all his hopes had been realized. It had been one of the satisfactions of his life to see the coming of age of the Society. He had felt from the first that there was a place, and an important place, for it. They needed not to be reminded of all the good work the Society had done, and of the honourable position it occupied.

## PROBLEMS OF CORROSION.

### What British Chemists are Doing to Solve Them.

Among the items to be dealt with at the Congress of Chemists and the forty-fifth annual meeting of the Society of Chemical Industry, to be held in London in July, a session of outstanding interest will be that on Tuesday, July 20, when a symposium is to be held, dealing with the subject of corrosion. In view of the fact that this symposium is a joint meeting of the British Chemical Plant Manufacturers' Association, the Institute of Metals, the Institution of Chemical Engineers, and the Chemical Engineering Group, it cannot fail to be of vital importance to the chemical industries. The costly effects of corrosion in every branch of engineering—and especially in chemical and gas works—are known to every constructional engineer and works manager; and if the chemist and metallurgist, between them, can remove them, they will be conferring a lasting benefit on British industry.

What British research has already done, and is still attempting to do, will be explained by a group of recognized authorities, including Mr. Ulick R. Evans, who will deal with "The Fundamental Principles of Corrosion," Mr. P. Parrish, who will speak on "Corrosion and Erosion," and Dr. W. H. Hatfield and Messrs. T. G. Elliott and G. B. Willey, who will discuss "Chemically Resistant Steels." It will be obvious that the problem is being attacked by men of considerable experience in the subjects involved. Possibly in no branch of metallurgy has there been such great advancement, both during and since the war years, as in connection with the production of chemical resistant steels and acid resisting irons. The introduction of novel methods of manufacture and the alloy of some of the newer and less common metals with iron and steel have produced alloys of a chemical resistance quite unprecedented; and the steels which are to-day being produced to withstand corrosion are far in advance of the earlier forms of stainless steels, which are chiefly martensitic. The newer corrosion-resisting steels are austenitic—*i.e.*, they are softened by quenching from a high temperature, as in the case of manganese steel—while the acid-resisting irons have been also greatly improved recently, from the points of view of both homogeneity and toughness, resultant upon careful methods of heat treatment.

**National Coal Products, Chemical, and Engineering Exhibition.**—This exhibition, which is being organized by Provincial Exhibitions, Ltd., at the request of the Manchester Section of the Society of Chemical Industry, and which will have the support of the Institution of Gas Engineers, the Coke Oven Managers' Association, and other organizations, will be held at the City Hall, Deansgate, Manchester, from Nov. 6 to 27.

**Modern Method of Collecting Drips.**—In New London, the Connecticut Power Company have in operation a schedule of times for collecting condensate, so that instances of full drips are very rare. According to Mr. F. A. Baker (General Superintendent), writing in the American Gas Association "Monthly," their present drip wagon is equipped with a 30 H.P. motor. On the chassis is mounted a 300-gallon welded-steel tank with a partition dividing it into two compartments—one of 75-gallon capacity, and the other of 225-gallon capacity. Mounted on the chassis, and driven from the power take-off of the horizontal transmission, is a pump so connected to the two compartments of the tank that condensate can be pumped into either tank, out of either tank, or from one to the other. By by-passing the tanks, the pump may be used for other purposes. This arrangement allows them to collect high-pressure drip water in one tank and low-pressure drip water in the other, or to carry alcohol for thawing drip risers in one tank and collect condensate in the other.

## COKE AND THE COAL CRISIS.

That important gas, electrical, and transport services are being maintained at practically their full normal efficiency in this, the ninth, week of the coal stoppage is an achievement for which those responsible are deserving of the highest praise. In the matter of tramway services London, compared with many provincial cities, is specially fortunate; the County Council service being maintained at its full normal efficiency, while in other towns the tramway services have been reduced by one-half, as a result of the closing of the mines.

The London County Council have been enabled to maintain normal working largely by the use of coke to supplement the coal consumed for generating electricity. As is well known, the ordinary power station is designed upon a coal-fuel basis, and is not equipped for, or capable of, substituting coke—however plentiful the latter fuel may be—and is therefore at a great disadvantage when suddenly required to accept an alternative fuel. This is the unfortunate position of many power stations in the present fuel crisis; but the London County Council, among other important electric tramway and electric power supply authorities, finding themselves within easy reach of the big gas-works of the Gas Light and Coke Company and the South Metropolitan Gas Company, recognized the practical and commercial advantage of an alternative fuel, and equipped their power stations some years ago, so that they could in an emergency take full advantage of the immense stocks of coal and coke necessarily maintained by these gas companies in order to ensure continuity of gas supply.

That the wisdom of this course has been entirely justified is evidenced by the fact that London tramway services, as well as certain electric railway and lighting services which are also supplied with current generated at coke-fired power stations, have, so far, been maintained at practically their full normal efficiency, and a considerably larger proportion of coke has been used during the present crisis than in any previous year since coke was first introduced as fuel for this purpose. The method employed in order to adapt the coal-burning mechanical stokers fitted at power stations to use coke is that known as the patent "Sandwich" system—so-called, not from the inventor's name, but by reason of the fact that, by means of a simple apparatus, the coke is "sandwiched" automatically between the travelling grate and an upper layer of coal dust, which serves to ignite it as it enters the furnace under the steam boilers.

The patent "Sandwich" system was first introduced during the acute coal shortage of 1918 by the London Coke Committee (who still freely advise steam users on its employment), and was then instrumental in maintaining vital public services, and in saving coal. The London County Council first adopted this system during that never-to-be-forgotten fuel crisis; and at the invitation of the Coal Controller then in office, the invention was inspected and adopted by many provincial electrical engineers, any question of patent rights being waived by the patentee in the national interest. During the coal strike of 1921 and the present closing of the mines, coke and the "Sandwich" system have played an increasingly important rôle in maintaining services essential to the life and well-being of the nation; but considered as an engineering achievement tending materially to conserve the nation's coal resources by utilizing low-grade coal and coke breeze, perhaps the most gratifying feature of this simple invention is the fact that since its adoption in an emergency as a means to alleviate the effects of a national fuel crisis, it has in most cases been retained in use on its merits as an economical innovation. Indeed, it has been incorporated in the design and is now used in several of the most economical power stations in this country, including the new super-station at Barton, Manchester.

## UNIVERSAL SMOKE ABATEMENT EXHIBITION.

**Bingley Hall, Birmingham, Sept. 6 to 18.**

Under the auspices of the Smoke Abatement League of Great Britain, an exhibition will be held in Bingley Hall, Birmingham, from Sept. 6 to 18. The venue of the exhibition is well known to gas men who visited the successful National Gas Exhibition held there in 1923; and the time is opportune for bringing before the general public the real need for a cleaner, brighter atmosphere. The Government's Smoke Abatement Bill is at the moment under discussion, but all history shows that legislation without a sound backing of public opinion is ineffective.

### Early History.

In no way is this more clearly shown than in the actual history of the smoke abatement movement. Over six hundred years ago the burning of sea coal in London was forbidden by law, and a Commission was appointed to seek out and prosecute all those who were evading the law. Those found guilty could be punished "for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces." No smoke abatement league could hope for anything more drastic than that; but nothing could have been more ineffective. We find continued outcries against the smoke-laden air of London and other cities throughout Elizabethan and Stuart times.

John Evelyn is better known for his "Diary" than for his "Fumifugium," but he was certainly one of the most forcible writers in the past on smoke abatement. Unfortunately he, like all his predecessors, had no cure to offer for the evil he decried, and therefore his outbursts were in vain.

### Gas Industry and Smoke Abatement.

The gas industry also has a good record for pioneer work in bringing before the general public the evils of atmospheric pollution, but it has a very real advantage over those earlier reformers, for not only do we decry the evil, but we point the cure. We are able to prove that the "clouds of smoke and sulphur, so full of stink and darkness," against which Evelyn railed, are not only objectionable, but unnecessary.

The object of the exhibition is to bring to the notice of the general public the means which are readily available for obtaining warmth and heat without polluting the surrounding air. In other words, we have to prove that comfortable homes and economical, scientific manufactories can be run without causing nuisance to our neighbours. The old saying "Where there is muck, there is money" has to be refuted.

The gas industry recognizes that, while little progress can be made by a purely academic appeal to the public to cleanse the air they breathe, great progress will result if they only show them that the more up-to-date methods—the smokeless methods—of heating are the best and most economical.

Many of the leading firms of gas appliance manufacturers have already taken space at the exhibition, and, thanks to the efforts of the energetic Gas Sub-Committee, all these stands will be grouped in one section of the main floor of the exhibition. The Midland gas industry is arranging a co-operative exhibit, on which will be shown a range of both gas and coke burning appliances. The correct method of fixing and providing flues for various types of gas apparatus will also be demonstrated. The British Commercial Gas Association is illustrating in an attractive manner what gaseous fuel can do in reducing atmospheric pollution. The Birmingham Gas Department will be well represented by stands showing domestic gas appliances, gas coke, coke fires, and coke boilers. The Industrial Research Laboratories of the Department are also arranging an exhibit of various gas-heated industrial appliances.

The electricity industry is taking a keen interest in the exhibition; and a large number of Electricity Corporations have already booked-up stand space.

Any unbiased person will admit that gas—together with its smokeless bye-product coke—represents the most practical and economical solution of the whole smoke problem, especially as investigators have proved that far the greater proportion of suspended matter in our atmosphere is evolved from the domestic grate. Our competitors are making a determined bid for this domestic heating load; and though to gas men who know all the facts such efforts may appear foredoomed to failure, yet experience has proved that it is unwise to sit still, and trust to facts to speak for themselves. Many a poor case has been saved by a good advocate; and unless it is plainly demonstrated to the public at this exhibition, and at others, that from national and personal standpoints they must look to the gas industry for up-to-date heating methods, we shall find our competitors gaining an advantage over us which will be reflected in subsequent sales.

It is hoped that all those firms who have not yet applied for stand space will do so without delay, so that positions may be assigned to them alongside other firms in the industry. By doing so they will assist the endeavours of the organizers to create a real all-gas section in the exhibition.

As with all exhibitions at Bingley Hall, the attendance of the general public is assured. To them a gas fire is a gas fire. But the exhibition will also attract prominent men interested in housing, medical officers of health, and welfare workers throughout the country. It is the interest and goodwill of these gentlemen that the Gas Sub-Committee are anxious to secure. They wish to prove to them that a gas fire is not only a gas fire, but that it is also a practical solution of many of their problems, and a means of translating into practice their ideal of a smokeless city. Exhibitors will therefore be well advised to bear in mind that, to obtain the full benefit from their outlay, their display must be definitely connected, by means of notices, &c., with the primary object of the exhibition—*i.e.*, smoke abatement.

During the exhibition the Smoke Abatement League of Great Britain will hold their Annual Conference, which will commence

on Tuesday morning, Sept. 7; the first day being devoted to a definition of the official policy of the League with regard to industry and smoke abatement. Papers will be submitted from smoke abatement leagues on the Continent and the colonies; and in the evening of Tuesday an official reception will be held, at which Sir John Robertson, C.M.G., O.B.E., M.D., B.Sc., Medical Officer of Health for the City of Birmingham, will deliver an address. On Wednesday the conference will consider housing and smoke abatement, when papers will be submitted by Councillor E. D. Simon (Manchester), Mr. Raymond Unwin (Chief Technical Officer, Ministry of Health), Mrs. C. S. Peel, and others. On Thursday the subject will be "Smokeless Production of Heat and Power," when a paper will be submitted by Dr. Margaret Fishenden.

Visits will be arranged during the week to Bournville and to other housing schemes in the vicinity of Birmingham.

The Gas Committee of the Exhibition consists of Mr. F. W. Goodenough, C.B.E., Mr. J. E. Cowen, President of the "B.C.G.A.," Ald. J. H. Lloyd, M.A., J.P., Mr. A. W. Smith, and Mr. H. Pooley. The members of the Gas Sub-Committee, of which Mr. A. W. Smith is Chairman, and Mr. R. J. Rogers Hon. Secretary, are as follows: Messrs. J. W. Allin, F. C. Briggs, F. Davies, E. Hardiker, P. N. Langford, and W. M. Mason.

## IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

### Gas Research Fellowship.

In our editorial columns, we conclude a comment on a lecture, delivered by Prof. Bone, D.Sc., F.R.S., on "The Combustion of Carbonic Oxide" (as reported in later columns), with a reference to the Gas Light and Coke Company's Research Fellowship, which was established in connection with the Department of Chemical Technology at the Imperial College for the purpose of encouraging experimental research in relation to carbonization, gaseous fuels, and combustion. The Fellowship becomes vacant on Oct. 1 next, and it may be useful to call attention to the principal conditions of tenure. They are as follows:

Any person shall be eligible for the Fellowship who, after having qualified in chemistry as principal, and mathematics and physics as subsidiary, subjects, either at the Imperial College or other British Institution of University rank, shall have spent at least one complete session in post-graduate study in the Department of Chemical Technology of the Imperial College, and have been placed in the first class upon such year's work, which shall include systematic courses in fuel technology (with refractory materials) and chemical engineering (as prescribed in the College Calendar), and have declared his desire to undergo a further two years' training (if necessary) in scientific research, with a view of qualifying for a responsible position in connection with some gas undertaking, or with the applications and development of gaseous fuels.

The Fellowship shall be tenable for one year in the first instance, and shall be renewable for a second year (but no longer) on receipt of a satisfactory report upon the first year's work from the Head of the Department of Chemical Technology for the time being.

The Fellowship shall be awarded during the month of July in the year that it becomes vacant; and shall be held by the person selected as from Oct. 1 in that year until Sept. 30 of the following year.

The award shall be made by the College authorities on the recommendation of the Head of the Department of Chemical Technology, who, before submitting his recommendation, shall confer on it with the Governor of the Gas Light and Coke Company for the time being.

The Research carried out by the Fellow shall be directed by the Head of the Department of Chemical Technology for the time being, and upon some subject selected by him in connection with carbonization and chemistry of gases or combustion, after conferring thereon with the Governor of the Gas Light and Coke Company for the time being.

The results of the research shall, if thought fit, be subsequently communicated to some scientific society or technical institution as the case may be; but all questions as to the time, place, and mode of such publication shall be determined on the recommendation of the Head of the Department of Chemical Technology for the time being.

It is to be understood that during his period of research training, but without interfering with his research, the Fellow will show an interest in the technical aspects of gas manufacture and the application of gaseous fuels generally; and with this end in view, he will from time to time, as may be convenient, visit gas-works for the purpose of acquainting himself with modern methods of gas manufacture, and the problems connected with the distribution and uses of gas. The Company on its part will afford him suitable facilities for such studies in connection with it own works and processes, and will from time to time confer with the College authorities as to the best means of achieving the objects of the Fellowship.

## NATIONAL PHYSICAL LABORATORY.

### Inspection by the General Board.

The Annual Inspection of the National Physical Laboratory took place on Tuesday, June 22. There was a large gathering of distinguished visitors, who were received by Sir Ernest Rutherford, O.M., President of the Royal Society, Sir Richard Glazebrook, K.C.B., F.R.S., Chairman of the Board, and Sir Joseph E. Petavel, K.B.E., F.R.S., the Director of the N.P.L.

Inspection was first made of the Aerodynamics Department, where, among other highly interesting investigations, experiments are being carried out on the Cierva autogyro, which may be briefly described as a wingless aeroplane. This type of aircraft derives its sustentation from a large airscrew free to revolve about a nearly vertical axis, while forward movement is achieved in the usual manner by means of an engine and propeller of normal design. In taking off, we were informed, the lifting airscrew is usually started by hand, and accelerates as the machine gains forward speed, until it develops sufficient rotational speed to cause the machine to rise. The take-off run is at least as long as that of a conventional aeroplane, but an almost vertical landing is possible, so that in certain respects the autogyro fulfils the functions of a helicopter. In the past—as all members of the gas industry who were in the Air Force during the war will know—inability to recover from spin was a fertile cause of aeroplane accidents. Demonstration in the Aerodynamics Department indicated that considerable advances have lately been made towards eliminating those features of aeroplane design which tend to prevent recovery from spin.

Among many interesting experiments in the Engineering Department, tests are being carried out to find what is the effect of a sudden shock on a lifting chain, such as occurs when the chain slips and the weight falls through a certain distance and thereby permanently lengthens the chain. The effect of annealing is being determined. With regard to rust-preventing materials, it was explained to us that experiments have been made with lanoline, with a view to its use for protecting machinery from rust, in place of imported petroleum grease. Boxes of test pieces, stored in exposed positions, have been sent on a three months' sea voyage.

At the high temperatures now employed in gas turbines, the metals used are apt to "creep" continuously at comparatively low stresses; and investigations are being undertaken to find a metal which undergoes no continuous distortion at temperatures *circa* 1500° Fahr. In this connection it is interesting to recall that in last week's "JOURNAL," p. 653, there were a few notes about Sir Robert Hadfield's "Era A.T.V." steel (which was exhibited at the conversazione of the Institution of Civil Engineers), creep-stress tests on which have shown that up to 700° C. the stress which the metal will support indefinitely is as much as 11 tons per sq. in.

The visitors were able to see the work which is being done in the Metallurgy Department, where X-rays are used in an intricate manner to determine the arrangement of the atoms in the crystals. Beryllium, which has recently been successfully produced by the N.P.L. in reasonable quantities, was exhibited. This is a very light, white metal which retains its polish for many months. It is nearly as hard as iron, and though it is somewhat rare, larger supplies are likely to be found if serious search is made.

The William Froude National Tank constituted a centre of attraction. Experiments have been in progress for some time with a view to determining the effect of rough seas on the behaviour and speed-keeping quality of ships. The experimental results are being checked against several ships. For this purpose members of the tank staff make various ocean voyages in rough weather.

The Metrology Department next claimed attention. This is responsible for the maintenance of standards of length, mass, and time. At present the standard of length is a manufactured metal bar. Experiments are in progress to ascertain the possibility of obtaining a natural standard; and it has been shown that the wave-length of light affords the possibility of such a standard of high precision. There was a demonstration of the interference rings formed when a beam of light is passed across a space between two surfaces. A beam of green light was projected through two parallel transparent mirrors on to a screen, where it exhibited a pattern of bright concentric rings. When the mirrors were slowly separated, the rings expanded and a new ring formed at the centre. The mirror separation had then been increased by half a wave-length of green light, or by about one hundred-thousandth of an inch. It is in this Department that graduated glassware is tested.

In the Physics Department there was an interesting demonstration of sound-wave photography. By passing an electric spark across a short gap, a single spherical sound pulse is produced; and by means of a second illuminating spark gap activated after a suitable time interval, the shadow of the pulse can be photographed. This method can be used for testing the acoustic properties of buildings by the use of sectional models.

We will terminate this sketchy description of a few of the many interesting exhibits by a note on a new hollow sphere, 10 ft. in diameter and whitened internally, which has been installed in the Photometry Division. This, which is believed to be the largest sphere employed for this purpose in the world, is to be used for measuring the efficiency of fittings for interior lighting, street illumination, and similar purposes.

# WAVERLEY ASSOCIATION OF GAS MANAGERS.

**Annual Meeting in Edinburgh, June 25.**

## PRESIDENTIAL ADDRESS

of Mr. LAWRENCE FARQUHAR, of Peebles.

I appreciate the honour you have done me, and am proud to occupy the chair of the Waverley Association. It would have given me still greater pleasure had our meeting been held in Peebles—"The Gateway of the Borders," that district with which our Association is identified—had circumstances permitted.

On casting about for a topic on which to address you, I recognized the difficulty of presenting anything in the nature of a novelty, and decided that an account of our tar dehydration plant would be of general interest, and perhaps assist others in the consideration of a similar scheme.

Before dealing with this, however, a few notes on the Peebles undertaking may not be out of place. Gas was first introduced into Peebles in 1829; and in 1898, when under the management of the late Mr. Alexander Bell, the works were purchased from the Gas Company by the Town Council for £14,360.

A vigorous campaign resulted in the installation of a large number of cookers and hotplates on the hire system, and later these were given free; the result being that we have almost reached saturation point in this respect. It is estimated that out of a total make of 50 million c.ft., the cooker load requires 30 millions per annum.

The present works were put down in 1904, and the old works converted into a Burgh depôt and plumbers' shop and stores for the Gas Department. There is no showroom, but the introduction of electric light in the near future may lead to developments in this direction. Since 1904 the make of gas has increased from 28½ millions to 50⅛ millions. One feature worthy of note is that, out of 1800 consumers, only 300 have ordinary meters; the remainder are chiefly shilling prepayment.

The works are situated over one mile from the town, with ample room for extensions. There is a railway siding running through the retort house at 12 ft. above the floor level, which facilitates the handling of coal, and another line is used for coke traffic, the coke being raised in a hopper-bottom skip. The cost of handling coal is approximately 4d. per ton, and of coke 1s. 6½d. per ton.

The retort bench consists of six beds of six retorts, 21 in. by 15 in. by 9 ft. long. Condensers are of the annular type, and the exhausters are Bryan Donkin, none of which calls for any special remarks. The washing and scrubbing apparatus consists of a Young's scrubber, which acts effectively but throws more back pressure than other types. It consists of a single rectangular vessel subdivided horizontally by twelve trays, the gas passing upwards under inverted tin caps against the liquor, which flows downwards in the same manner as in a sulphate of ammonia still.

There is a shortage of holder accommodation; the two-lift column-guided holder, with a capacity of 130,000 c.ft., having to meet a maximum daily output of 210,000 c.ft. In mid-winter the effective capacity, with adequate pressure, is only 65,000 c.ft., owing to the deficiency of pressure thrown by the inner lift.

The Gas Regulation Act came into operation in May, 1925, and the declared value is 520 B.Th.U., but the average value supplied is 560 to 570 B.Th.U.—which may seem to indicate the supply of heat units free. With a company this would be so, but under municipal control no loss is actually suffered, as the consumer balances the accounts by paying more or less as the case may be. It is intended to work down to the declared value in time, but to avoid a sudden transition. There are still many flat-flame burners in use throughout the district. The declared value is, I think, the highest in Scotland.

Sending out a straight coal gas of this description, I have been impressed with the fact that constant pressure and quality are as essential with a rich gas as with one of lower quality. Any variation, though still above 520 B.Th.U., leads to complaints, happily of a mild character; and in winter, especially when lighting-up time and the tea hour coincide, the variation in pressure due to the draw on the mains produces the same result. In common with many other places, inadequate services are all too common—such as a ½ in. service to supply six houses.

Public lighting is on the "A & M" system, operated by a booster driven by a high-speed engine. This is no doubt a more expensive method than that of using a steam jet in the main, but, personally, I regard it as being more positive and much more satisfactory.

Dealing now with the plant for dehydration, I offer an account of our experiences, in the hope that it may be of use to some who have not yet considered installation of tar plant, or who, having thought the matter over, are doubtful of its merits. For some time crude tar has been yielding a very poor return, and even now, with a rising market. Small works can, I believe, produce a road tar and show a handsome profit.

According to the N.G.C. scheme for sale of tar, the average price has been as follows: 1923-24, 49s. 7d. per 100 gals.; 1924-25, 23s.; 1925-26, 23s. 10d. From this must be deducted cost of carriage to distillers' works, which in the case of Peebles was 6s. 3d. per ton. Where the local authority own the gas-works and use the tar produced on their own roads, the benefits cannot be overlooked. Carriage on crude tar to the distillers' works is saved on the one hand, and on road tar from the distiller to the town on the other. On several occasions, also, our tar has been removed from the works while still warm, effecting a saving in time and labour in its application to the roads.

Before putting down the plant, it was ascertained that there was a local market. This point I would stress as being an important factor. Our annual output of roughly 250 tons is disposed of to the burgh and county, with the exception of small lots supplied for the tarring of deep-sea fishing nets.

There are various plants on the market. While confining myself to our own installation, I am fully aware that there are other makes which are also simple, safe, and reliable. The Peebles plant is on the Clayton cascade system, and has a capacity of 50 gallons per hour. Described briefly, it consists of a still 10 ft. long by 2 ft. diameter, a heat interchanger 11 ft. 6 in. long and 1 ft. diameter, a condenser, oil separator, and the necessary storage tanks. The still and interchanger are carried by a brickwork setting, with furnace under the front end of the still. The whole plant occupies a ground space of 12 ft. by 25 ft.

All the tar and liquor made on the works flows to a circular underground storage tank, with a capacity of 70 tons, from which the tar can be pumped either to the overhead supply tank or into tank wagons on the railway. The large tank and the supply tank are steam heated in cold weather. Any liquor passing to the supply tank separates out, and the tar outlet is on the underside. The tar runs by gravity into the crude tar inlet box or weir head, where the flow to the plant is regulated. It passes through the heat interchanger, back to front, and is preheated by the outgoing prepared tar. At the front end it rises in a 2-in. pipe and enters the crown of the still, flowing backwards in a thin film over a series of seven steel plates arranged in cascade form, losing, as it does so, the water and light oils. It then drops to the bottom of the still, flows to the front again, and passes to the heat interchanger. After flowing through this it runs from a swivel pipe into the prepared tar tank, from which barrels are filled.

The water vapour and light oil pass to a condensing coil and thence to a separator, whence the oils run to a steel drum and the water flows to the liquor well. The obnoxious gases coming from the coil are trapped, and led to a small purifier.

The furnace is a simple one, 3 ft. 6 in. by 1 ft. 3 in., and the flue runs under the still and the heat interchanger, and then to a short metal chimney. A main damper and two small dampers control the draught. Fuel consumption is light—approximately 100 lbs. of coke breeze per ton of tar dehydrated. The plant is not subjected to any undue corrosion, and a light roof protects the brickwork. A safety valve is also provided.

The cost of the plant, excluding supply tank, pump, prepared tar tank, and oil separator, which were available on the works, but including labour in erecting and fitments, was £404.

Running costs:

| | s. | d. | |
|---|---|---|---|
| Wages | 2 | 0 | per 100 gals. |
| Fuel | 0 | 3 | ,, ,, ,, |
| Total | 2 | 3 | ,, ,, ,, or 0·27d. per gal. dehydrated. |

Interest and depreciation over five years, less income from crude benzole, brings the total cost of dehydrating to 62·92d. per 100 gals. The increased revenue from tar after dehydration is in our case 19s. 10½d. per 100 gals. No account is taken in the above of steam consumption, as this would be the same pumping either into tank wagons or into the overhead supply tank, and no allowance is made for labour had the tar been loaded into tank wagons. One man can run the plant and fill barrels with ease, and no doubt labour costs would be proportionately less with a larger plant.

During the throughput of over 250 tons no trouble has been experienced in working, except on one occasion in no way due

to defects in the plant. When cleaning out the Young scrubber in former years the sludge on the trays was thrown on the ash tip. Last year it was thinned out with crude benzole and run back to the tar well. Immediately afterwards the tar plant failed to flow freely, and the tar was thrown over the condensing coil. Naphthalene was found to have filled the tar outlet from the still. The front end plate was removed for inspection at this time, and the interior of the still was perfectly clean after approximately 90 tons had been dehydrated. The flexibility of the plant is all that can be desired; it will deal with tar of widely varying composition and water content.

At one time tar was dehydrated on the works in a Lancashire boiler shell with steam coils running from end to end. No data of results are available, but as far as can be ascertained little oil was removed, though probably most of the water was driven off.

In a small works, where no arrangements exist for elaborate testing, it cannot be expected that the finished product will be turned out so that every gallon complies with the Road Board specifications, which to my mind are too exacting. It is questionable, even where facilities exist, whether it would pay to adhere strictly to a fixed composition. By repeated trials, observation, and testing for viscosity, a dehydrated tar of fairly uniform consistency can be produced to meet the requirements of those who are to use it. The consistency required by our customers was found by trial, and the temperature of the still which suited best was 220° C. For trawl nets a lower temperature was attempted, in an endeavour to retain as much oil as possible. At about 160° C. the crude tar did not flow rapidly enough, so now we run the plant for this purpose at about 210° C., and return a portion of the oil driven off. A Hutchison tar tester has been used lately, and is of great assistance in keeping the quality constant. I may mention here that a tar dehydration plant must be passed by the Alkali Inspector, and a fee of £6 per annum paid to the Ministry of Health.

The tarring season is naturally determined by weather conditions; and it is necessary to store the winter production for use in the spring. A supply of barrels enabled us to dehydrate early in the year, before road-making commenced, and to supply immediately the demand came on. Even in the "off season" patching can be carried out, provided the weather is mild and dry; but possibly there is a tendency at such times to use cold patching material in preference to tar.

As regards the application of tar to roads, the Ministry of Transport have issued a booklet on the subject entitled "General Directions and Specifications relating to Tar Treatment of Roads." Actual practice, however, calls for judgment in planning the work, and a considerable degree of skill in carrying it out. Peeblesshire, I think, can claim that its tar-bound and surfaced roads are of the highest standard.

Much has been said and printed of late regarding the relative merits of tar and bitumen compounds, and much of the ground lost to tar has been due, not to the inherent superiority of bitumen, but to a vigorous boosting. Tar, however, will ultimately come into its own. No one can deny that tar spraying of both tar and water bound roads prolongs their life and removes, as far as possible, the dust nuisance. The tar-surfaced road has a hard non-skid surface, especially suitable for present-day traffic. The tar penetrates into the aggregate, keying it together, and—an important factor—the cost of tarred roads is less than that of other types in first cost and maintenance.

Crude tar has been used for tarring roads after the water and light oils have been removed by boiling in tar boilers at the roadside; but it is impossible to get a constant grade of tar by this method. Not only is there a danger of priming and of the tar catching fire, but by this rough and ready preparation the light oils are lost and the obnoxious gases are discharged into the atmosphere, contrary to the enactments relating to tar distillation. Doubtless it has been the use of tar in this manner which has led to the condemnation of tar in the neighbourhood of fishing streams. The scum formed by ammoniacal liquor in crude tar drains with the road washings into streams, and assists that other source of pollution, oil from motor vehicles, in poisoning fish. I cannot find any trace of fish being destroyed in this country, though the greater part of the roads is tarred. I am convinced that, properly prepared and applied, tar is free from blame in river pollution.

The following comparison is made between the Road Board specifications and a sample of tar supplied by us for road spraying.

| — | Road Board Specifications. | | Peebles Sample. |
|---|---|---|---|
| | Tar No. 1. | Tar No. 2. | |
| Specific gravity not higher than | 1·225 | 1·240 | 1·220 |
| Water or ammoniacal liquor not more than (by weight), p.ct. | 1 | 1 | 0·16 |
| Other distillate to 170° C., p ct. | 1 | | |
| Distillate 170° to 270° C. (by weight), p.ct. | 12–24 | 10–18 | 18·54 |
| Distillate 270° to 300° C. (by weight), p.ct. | 4–12 | 6–12 | 4·98 |
| Phenols or crude tar acids (by vol.), p.ct. | 5 | 4 | 5·43 |
| Naphthalene (by weight), p.ct. | 8 | 5 | 4·26 |
| Free carbon (by weight), p.ct. | 22 | 24 | .. |
| Consistency or viscosity (Hutchison) at 25° C., seconds | 3–20 | 20–100 | 7 |

We have no means of measuring the crude tar used to produce the prepared material, and in the first season's working there has been no accurate measurement of tar dispatched. The barrels used are nominally 40 gal., but these vary considerably, and the discrepancy has undoubtedly been in favour of the purchaser. To obtain accurate measurement, a platform weighing machine has been purchased, and the 40 gals. per barrel will be weighed out. It is proposed to place the weigh-bridge in such a way that the barrels can be filled when in position for weighing.

In conclusion, I note with satisfaction that the British Road Tar Association has been formed to further the use of tar for road-making purposes, and to combat the effects of the campaign designed to substitute foreign bitumen in place of home-produced tar. Such an organization should go far to secure for British road tar the recognition which it merits.

[A report of the proceedings will be given next week.]

## NOTES ON NEW BOOKS.

### Modern Telpherage and Ropeways.*

The most important feature in the lay-out of any gas-works is the means adopted for the handling of coal and coke, and generally the latter is more difficult than the former. The electric telpher as a means for coping with both materials has been in use in gas-works for about twenty years; and the present book is a distinct acquisition to the gas engineer's library, seeing that no treatise has hitherto been published dealing exclusively with telphers and ropeways. In Zimmer's well-known work on the handling of materials, telphers are treated in a comparatively short chapter, while ropeways are given much more detailed consideration.

Mr. Blyth appears to have held the balance evenly in his treatment of the various aspects of the subject-matter comprised within the limits of the title. He deals with skips and skip loaders in relation to the work of the telpher, and with the important matter of control both semi and fully automatic.

The book contains much useful information regarding capital and running costs, and Chapter XI. is almost entirely devoted to costs of coke handling at the Portsmouth and Smethwick gas-works, extracted from information given by the respective engineers. The author has not omitted to date all the costs given, and this is an important factor when considering new work, owing to the fluctuation of prices during the past five years. This particular chapter would have been rendered much more valuable had corresponding costs been given for other well-known types, either the push-plate conveyor combined with elevator, or the gravity-bucket conveyor. However, we can be assured by a perusal of the figures that coke handling in large quantities need not exceed 10d. to 1s. per ton in a well-designed telpher plant, including interest and depreciation. In dealing with coke handling, the author rightly stresses the importance of the handling and quenching operations in relation to the formation of breeze.

In the chapter dealing with grabs, only four types are considered—viz., Bacon, Barnard, Priestman, and Williams—all of which are known to gas men. The author rightly omits all those which he considers unsuitable for telpher work, and concentrates on those which he knows from experience to be the most useful. The Priestman single chain grab is presumably that firm's development of the original "Hones" grab, which is a popular one in the gas industry.

Telpher tracks and trestles are treated practically as well as theoretically, and a fully calculated example is given of a long-span track subject to wind pressure. Useful dimensioned sketches are included, as well as a table giving rolled sections for various trestle lengths. The section given in the table for a particular length, however, does not agree with the standard diagram trestle of that length, and there is no indication in the text that a different method of treatment has been adopted.

The chapter on the storage of materials on open ground, considered in relation to reclaiming requirements, is limited to ten pages. This seems inadequate for such an important branch of the subject, though many useful drawings and illustrations are included. The transporter could have been dealt with more fully and still have been within the book's scope, but the author was probably faced with the problem of keeping within certain limits. The ropeway and cablings sections are not of such importance for the gas man, but many useful hints can be obtained from a perusal of these chapters. The book is well illustrated, containing about 127 illustrations in all; the index is deficient, as in many other technical works. Two pages of index are not sufficient for a book of this nature.

The volume can be recommended to every gas engineer as an interesting and authoritative work giving exactly the information which is necessary when considering the installation of new plant of this nature. G. E.

* "Modern Telpherage and Ropeways," by Herbert Blyth, M.Inst.C.E. 154 pp., *plus* illustrations; 27s. 6d. net. Ernest Benn, Ltd.

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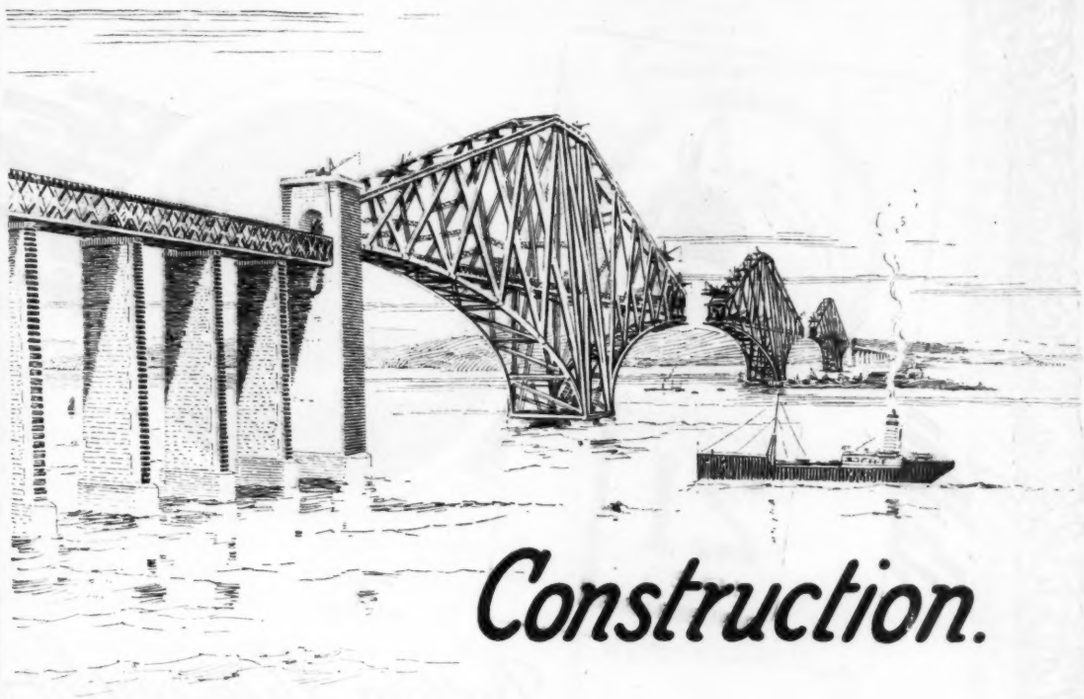

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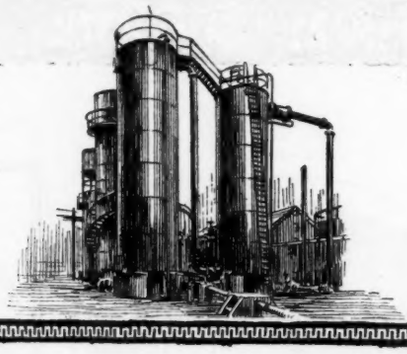
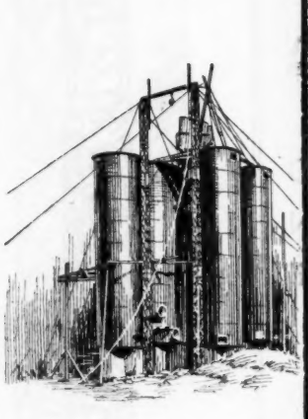
Radiation





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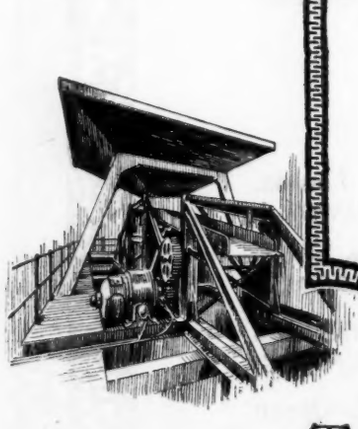

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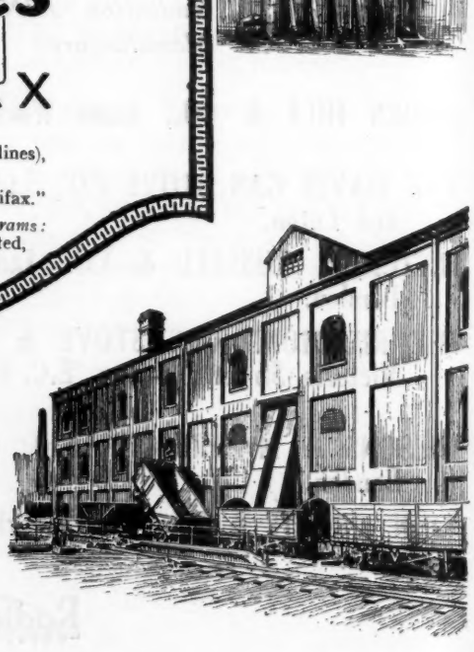

150—1°0.

# THE COMBUSTION OF CARBONIC OXIDE.

**A Lecture by Prof. William A. Bone, D.Sc., F.R.S., of the Imperial College of Science and Technology, London, before the Gas Light and Coke Company, London, on June 24, 1926.**

It was a distinguished gathering of scientists and engineers that assembled at the Horseferry Road Offices of the Gas Light and Coke Company, at the invitation of the Governor and Court of Directors of the Company, to hear Prof. W. A. BONE, D.Sc., F.R.S., of the Imperial College of Science and Technology, give a lecture on the combustion of carbon monoxide, on which subject he and his collaborators have carried out a large number of most valuable investigations. In this lecture Prof. Bone devoted most of his time to an account of the experiments which Mr. F. R. Weston, B.Sc., A.R.C.S., D.I.C., has carried out under his direction during the past three years. Mr. Weston is the first holder of the Gas Research Fellowship which the Gas Light and Coke Company founded at the Imperial College three years ago. Towards the close of the lecture, Prof. Bone indicated the nature of the results obtained by Mr. R. P. Fraser—who is the holder of the Gas Research Fellowship established a year ago by Messrs. Radiation Limited—on the influence of pressure on the ignitibility of a rigidly-dried $2CO + O_2$ mixture. The lecturer illustrated his remarks by a series of lantern slides, and the interest which his lecture evoked was enhanced by some highly successful experiments on the rate of flame propagation of hydrogen-oxygen and carbon monoxide-oxygen (dried and undried) mixtures.

Mr. D. MILNE WATSON, D.L., the Governor of the Company, who presided, said that about three years ago the Directors of the Gas Light and Coke Company decided to endow a Fellowship at the Imperial College of Science, for research in relation to gaseous fuels and combustion. This step was taken primarily because of a realization of the importance of research to industry, and of the responsibility of large industrial undertakings such as their Company to support in every possible way any research bearing upon the undertakings. They realized the importance of scientific research work, even if the technical applications of any fresh addition to knowledge were not immediately apparent. It might even be that the technical applications of the experiments which they had invited those present to witness that day were not immediately apparent; but despite the fact that they were away from the environment of the University, and away from all that this meant to the scientific worker, they were not unmindful of the kind of research which preceded such inventions as the incandescent mantle and wireless telephony. Indeed, they believed that their future depended ultimately upon such research. A further reason for the establishment of the Research Fellowship was a desire on the part of the Directors of the Company to recognize the value of the work of the Imperial College, and of the scientific contributions of Prof. Bone to the gas industry. In instituting the Fellowship, it was arranged that the research carried out should be directed by the head of the department of Chemical Technology at the Imperial College. The subject chosen for research by Prof. Bone was the spectroscopic investigation of the flames of carbon monoxide and hydrogen. It was naturally a source of gratification to the Directors, concluded Mr. Milne Watson, that the work of the first Fellow should have led, under the direction of Prof. Bone, to results of real scientific importance, for it was understood that the later experiments, some of which they were to see that day, threw a new light upon the whole mechanism of combustion.

## THE LECTURE.

### INTRODUCTION.

In response to the invitation of the Governor and Court of your Company, I have come to address you on the subject of carbonic oxide, a veritable Dr. Jekyll and Mr. Hyde among gases. There have been occasions when its murderous deeds as Mr. Hyde have moved some of us to anger, and a strong desire to chain up the beast; but when, a week or two later, it comes into our laboratories as the benevolent Dr. Jekyll, we are set wondering was there ever so beautiful and attractive a personality among gases. And so it has come to pass that, having in days gone by warned my friends and neighbours about the evil genius of Mr. Hyde, I am now more happily engaged upon the task of delineating the virtues of the good Dr. Jekyll.

Ever since I was initiated into scientific research by my old master, Prof. H. B. Dixon, in Manchester, 35 years ago, it has been my delight to investigate the never-ending problems of gaseous combustion; and it was from him that I first learnt about the truly wonderful character of carbonic oxide, which has ever been an enigma to chemists. I have always felt that, could we but penetrate the secret of its combustion, we would discover the key which would unlock many other doors. And, therefore, when I was called from Leeds University to establish the new fuel research laboratories in connection with the Department of Chemical Technology at the Imperial College of Science in London, I decided to make the combustion of carbonic oxide one of our chief concerns there. So that for some time past it has been occupying our attention, and we are now beginning to publish some of the results of our researches. And when, three years ago, your Company generously founded a Gas Research Fellowship in connection with our work, I felt that we could not make better use of its first holder (Mr. F. R. Weston, B.Sc., A.R.C.S., D.I.C.) than to entrust him with a certain section of our researches upon CO-combustion, which, I am glad to say, he has carried out most skilfully and with complete success. This being so, I feel sure that it will be fitting, and meet with your approval, for me to devote most of the time at my disposal this afternoon to giving you an account of the experiments which he has carried out under my direction during the past three years.

As a preliminary, however, it is desirable for me to direct your attention for a few moments to some of the problems presented to the chemist in the combustion of carbonic oxide, in order that you may be better able to judge how far your Research Fellow has helped us to solve them.

### COMBUSTION OF CARBONIC OXIDE AND HYDROGEN COMPARED.

In order that we may get down as quickly as possible to bed-rock in the matter, I will ask you to consider with me for a few moments the great contrast there is between the outward and visible aspects of what *apparently* are the two simplest cases of gaseous combustion—namely, those of hydrogen and carbonic oxide. I use the word "apparently" advisedly, because as soon as we go beyond mere externals and begin to explore gaseous combustion, we find ourselves faced with most baffling and elusive complications, and are made to realize there is nothing at all simple about it. Also, lest I should be accused of inveigling you into a purely academic discussion, may I remind you that water gas is essentially a mixture of carbonic oxide and hydrogen in nearly equal volumes, and that carbonic oxide enters largely into the composition of other industrial gases. Let us then begin by considering first of all in what respects the phenomena associated with the combustion of hydrogen and carbonic oxide, respectively, are similar, and then in what respects they differ. In the first place, they are very similar in that:

(1) the volumetric proportions in which either gas combines with oxygen (air) are the same;
(2) their volumetric heats of combustion, when burnt in a calorimeter so that the products are cooled down to atmospheric temperature, are very nearly so; and
(3) in admixture with air each has a wide range of inflammability.

Thus we find:

| Combustion Equations. | On Combustion 1 C.Ft. Gas at 60° Fahr. and 30 In. Pressure. | |
|---|---|---|
| | Requires. | Develops. |
| $2H_2 + O_2 = 2H_2O$<br>$2CO + O_2 = 2CO_2$<br>1 vol. + ½ vol. 1 vol. | 0·5 c.ft. oxygen<br>2·385 ,, air | 326·8 B.Th.U.<br>324·0 ,, |
| | Range of Inflammability at 15° C. and 760 mm. | |
| Hydrogen-air mixtures<br>CO-air mixtures . . | 4·1 to 71·5 p.ct.<br>12·5 to 73·0 p.ct. | |

In nearly all other respects, however, the two gases behave quite differently; thus, for example, it has long been known that:

(1) the appearance of a hydrogen flame burning in air is quite different from the characteristic lambent blue flame of carbonic oxide;
(2) a carbonic oxide flame burning in air radiates nearly 2·4 times as much energy per unit volume of gas burnt, as a hydrogen flame of the same size;
(3) under similar conditions, hydrogen-air mixtures have lower ignition temperatures and propagate flame much faster than the corresponding carbonic oxide-air mixtures (*e.g.*, whereas the initial uniform flame speed for a moist, stagnant 40-60 hydrogen air mixture in a 1 in. diameter tube at 65° Fahr. and 30 in. bar. is about 15 ft. per second, for the corresponding moist CO-air mixture it is only about 2 ft. per second).

### SOME PRACTICAL CONSIDERATIONS.

In this connection, there arises a very important practical consideration in regard to the industrial uses of certain gaseous fuels which hitherto has never been explained properly.

It has long been known among practical steel-makers that, *ceteris paribus*, carbonic oxide is a much better open-hearth furnace fuel than hydrogen; indeed, I have heard experienced steel-makers say that, while the CO-content of a "producer gas" for their furnaces cannot be too high, the presence in it

of more than about 12 p.ct. of hydrogen is a disadvantage. There is no doubt that, for such purposes, the steam-saturation temperature of the air-blast used to gasify the solid fuel in the producer should (if possible) not exceed 50° C., under which conditions the resulting gas (from a bituminous coal) would have the following approximate composition:

$$CO_2 = 3{\cdot}0\,;\ CO = 30{\cdot}0\,;\ H_2 = 12{\cdot}0\,;\ CH_4 = 3{\cdot}0\,;\ \text{and}\ N_2 = 62{\cdot}0\ \text{p.ct.}$$

Steel-makers say that a gas of such composition gives what they describe as a good "soaking" heat in their furnaces, as contrasted with the "cutting" heat of a producer gas in which (say) the proportions of hydrogen and carbonic oxide are reversed. Moreover, though a good water gas, as generated from a good gas coke, contains (say) 42 p.ct. of carbonic oxide and 48 p.ct. of hydrogen, the appearance of its flame and its behaviour in a furnace are much more like that of hydrogen than those of carbonic oxide. Thus it is an excellent fuel for steel welding purposes, for which it is so largely used. What I wish, however, to convey to you by these references is the fact that, in the experience of practical men using gaseous fuels daily in industrial operations, it seems as though, when the two gases are burnt together, hydrogen is, so to speak, the stronger partner, having the power of imposing its characteristic "mode" of combustion upon the carbonic oxide. And we may well ask whether, and (if so) how far, scientific investigation can throw any light upon this aspect of the matter. Therefore I feel that no further apology is needed for inviting you to accompany me in a tour of inspection of our research laboratories.

## H. B. Dixon's Discoveries at Oxford in 1880.

First of all, I will ask you to imagine that we are visiting H. B. Dixon's laboratory (as it then was) at Balliol College, Oxford, in the year 1880. We would find him engaged in repeating Bunsen's well-known experiments upon the division of oxygen between carbonic oxide and hydrogen, when both are present in excess; and he would astonish us by declaring that he had just discovered that a mixture of carbonic oxide and oxygen, dried by long contact with phosphoric anhydride, will not explode when sparked in the usual way, in a eudiometer over mercury, though the presence of moisture, or, indeed, of any gas containing hydrogen, at once renders the mixture explosive.

## Theories as to the Function of Steam in the Combustion of Carbonic Oxide.

Such a discovery naturally attracted much attention in scientific circles, because of its obviously fundamental importance; and at once chemists began to discuss what could be its meaning, naturally without agreeing at all about it. At the time Dixon himself supposed that carbonic oxide and oxygen do not directly combine, but are mutually inert, in flames, requiring the interaction of steam as a "carrier of oxygen," so that it is really the hydrogen which combines with the oxygen to form steam, which then hands its oxygen on to the carbonic oxide, regenerating hydrogen, as follows:

$$1.\quad 2H_2 + O_2 = 2H_2O$$
$$2.\quad CO + OH_2 = CO_2 + H_2, \text{ and so on.}$$

Several modifications of this view were put forward at various times, all of which agreed in supposing that in flames and explosions carbonic oxide is always *indirectly* oxidized through the medium of either steam or hydrogen peroxide but never *directly* by oxygen; and if you had attended the meetings of the Chemical Society during the decade 1885-1895 you would have at least discovered how great an amount of heat is generated in chemical controversies about issues which the uninitiated might perhaps regard as unimportant from any practical standpoint. Notwithstanding such differences of opinion as to *how* steam acts, it was generally agreed among all the disputants that its presence is in all instances essential to the combustion of carbonic oxide; and I think we might say that this view has in one form or another prevailed generally during the past forty years.

## Objections Against the Chemical Theories.

Several weighty objections, however, may be urged against it. First of all, the colour and general appearance of a carbonic oxide flame are so different from those of a hydrogen flame, which hardly accords with the "indirect oxidation through steam" theory. Second, that a carbonic oxide flame radiates 2·4 times as much energy as a hydrogen flame of the same size. While a third was the discovery by H. B. Dixon,* in 1895, that the flame produced by the detonation of a well-dried mixture of cyanogen with twice its own volume of oxygen, in which carbonic oxide is transiently formed as an intermediate product, when analyzed upon a rapidly moving film "does not appear to differ from the flame given by the same gases when mixed with 1·5 p.ct. of water." Indeed, as Dixon concluded at the time, such a result can hardly mean other than that "in a mixture of freshly formed carbonic oxide and oxygen, these gases unite as the mass cools down, without the intervention of steam." But so strong was the prevailing opinion that the intervention of steam is *essential*, that such an isolated result did not alter it.

Another difficulty in accepting the postulated *chemical* intervention of steam in the combustion of carbonic oxide is the exceedingly small amount of it which "makes all the difference." Some years ago the eminent American chemist E. W. Morley showed that the mere passing of a gas slowly through a long column of phosphoric anhydride reduced its moisture content to less than 4 per 1000 million molecules; and yet such an infinitesimally small amount more than suffices to render a mixture of carbonic oxide and oxygen explosive when an electric spark is passed through it. Indeed, this fact has always constituted a great difficulty from the kinetic standpoint in explaining how the steam functions in such a case.

## Recent Investigations (1923-26).

Coming now to recent years, it was discovered (in 1923), in the course of the researches at the Imperial College upon gaseous combustion at high pressures, that the presence or otherwise of water vapour has very little influence upon the rate of pressure development in the explosion of a theoretical CO-air mixture at an initial pressure of 50 atmospheres, as the following results indicate:

| Hygroscopic State of the Gases and Explosion Chamber. | Time Taken for Attainment of Maximum Pressure. Secs. | Maximum Pressure Developed, Atmos. | P.Ct. Pressure Fall in 0·5 Sec. After $P_m$. |
|---|---|---|---|
| 1. $P_2O_5$—dried . | 0·18 | 400 | 9·0 |
| 2. Undried . . | 0·15 | 411 | 10·0 |
| 3. Moist . . . | 0·19 | 395 | 11·5 |

These results suggested to us, and independently to H. B. Dixon also, that, supposing (as we believed) the "dryness" of the bomb system in our series 1 experiments could be relied upon, carbonic oxide combines directly with oxygen at high pressures without the intervention of steam. Hardly had the hunt picked up this new scent than it was joined by Mr. F. R. Weston, as your newly-elected Gas Research Fellow; and so, to test his powers, he was deputed to follow it up, and, if possible, secure the quarry. Let us now consider how far his efforts have succeeded.

## Spectrographic Investigations.

The first thing which Mr. Weston was set to carry out was a systematic investigation of the flame spectra of hydrogen and carbon monoxide, as well as of mixtures of the two gases in different proportions. In this connection we had the collaboration of my colleague, Prof. A. Fowler, F.R.S. (Yarrow Research Professor of the Royal Society), one of the highest living authorities in spectroscopy. Jets of highly-purified gases were burnt, either in air or in an atmosphere rich in oxygen, at a quartz orifice in front of the slit of a Bellingham quartz spectrograph. In this way a series of flame spectrograms, each over a range of 5000 AU in the visible region down to 2200 AU in the ultra-violet,* were obtained; from there the six shown in the accompanying plate have been selected as illustrating the principal features observed.

In each case the spectrogram shown is that of a flame burning in an oxygen-rich atmosphere. A jet of the combustible gas was ignited as it issued from the expanded orifice A of the 1 mm. bore quartz tube BB (fig. 1), which had been previously expanded in the oxy-hydrogen blowpipe until it had acquired the particular form shown in the diagram. The quartz tube was suitably mounted co-axially with a wider glass tube CC (internal diam. 8 mm.), having a side-arm D, through which a stream of oxygen was maintained. The flame at the orifice A was thus surrounded by an atmosphere of oxygen; the jet was placed at a distance of about 1 cm. from the slit S of the spectrograph. The (undried) combustible gas, previously stored over a mixture of equal volumes of glycerine and water, was burnt at a constant rate of 10 litres per hour; a 45 minutes' exposure was allowed in taking the spectrograms, Imperial Ordinary plates being used.

Spectrogram No. 1, which was obtained from a flame of pure (undried) carbon monoxide, shows a very strong continuous spectrum extending from about 5000 AU in the visible region to about 2200 AU in the ultra-violet. This is a characteristic feature of the carbonic oxide flame spectrum. When, however, a jet of carbonic oxide is burnt in air instead of an oxygen-rich atmosphere, so that the intensity of the spectrogram is diminished, it is seen that this continuous spectrum overlays an equally characteristic banded spectrum, which becomes very prominent under reduced pressure.

No. 5, which was obtained from a flame of pure hydrogen, shows practically nothing in the visible region of the spectrum, but several groups of characteristic "steam lines" in the near ultra-violet, including a very prominent group round about 3200 to 3060 AU. It is only necessary to compare the spectrogram Nos. 1 and 5 to show how different is the radiation from a hydrogen flame from that emitted by a carbonic oxide flame. In this connection it should be noted that "steam lines" are usually faintly visible underlying the characteristic continuous

* "Trans. Chemical Soc.," Vol. 69 (1896), p. 773.

* 3800 AU, or thereabouts, is the boundary between the visible and the ultra-violet parts of the spectrum.

spectrum in the spectrogram of a flame of undried carbonic oxide burning in air, but not when both the carbonic oxide and the air have been been previously well dried.

Nos. 2, 3, and 4 were obtained from flames in which the combustible gas was a 78 : 22, 53 : 47, and 25 : 75, respectively, carbon monoxide-hydrogen mixture. No. 3 may therefore be regarded as the spectrogram of a water-gas flame. The important point brought out by these spectrograms is that increasing additions of hydrogen to a flame of carbon monoxide cause a rapid diminution of the characteristic continuous and banded carbonic oxide flame spectra, until, when the water-gas (equimolecular) composition is reached, they have almost entirely disappeared.

No. 6, which was the spectrogram of a flame produced by burning a mixture of equal volumes of carbon monoxide and nitrogen in the aforesaid oxygen-rich atmosphere, shows (by comparison with No. 3) that the influence of hydrogen is a specific, and not merely a diluent, influence.

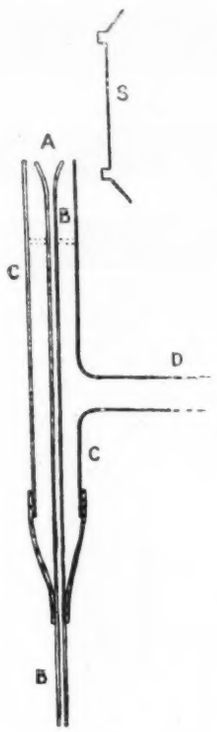


Fig. 1.

Prof. Fowler kindly made a detailed examination of the wide range of spectrograms obtained during this part of the investigation; and in particular he analyzed the banded part of the carbonic oxide flame spectrum, which is clearly visible when the gas is burnt in air. The detailed results of the investigation, together with Prof. Fowler's analyses and my own observations thereon, have already been published in two papers communicated by Mr. Weston to the Royal Society a year ago (see Proc. Roy. Soc. A. 109 (1925) pp. 176-186 and 523-526), to which reference may be made. But as the time at my disposal does not permit of the matter being pursued further, it will perhaps suffice if I now state briefly what conclusions have been drawn from the spectrographic evidence thus obtained.

I think the experiments show conclusively that, when carbon monoxide burns in undried air or oxygen, two sets of independent interactions occur simultaneously—namely (*a*) *direct* interactions between carbon monoxide and oxygen, exciting radiations which give rise to the continuous and banded parts of the spectrum, as well as to the characteristic blue colour of the flame; and (*b*) interactions between CO and $OH_2$ molecules, which originate the "steam lines" in the spectrum. When, however, hydrogen is gradually added to the burning gas, the relative proportions of the first-named direct interactions diminish rather rapidly, and proportionately more of the carbonic oxide is burnt indirectly by interaction with steam-molecules, until, when an equimolecular mixture of carbon monoxide and hydrogen is reached, the CO-$OH_2$ interactions occur to the practical exclusion of the direct CO-oxygen interactions. Indeed, the importance of Mr. Weston's spectrographic work in regard to the mechanism of CO-combustion lies in the fact that it has given us what H. B. Dixon has described as "the first clear evidence that in an ordinary CO flame both the direct and indirect actions are going on at once." And I think your Company may take pride in the fact that it is through the work of their first Gas Research Fellow that such important new light has been thus shed upon this much debated question.

### Effect of Progressive "Drying" upon the Minimum Condenser Discharge Required to Ignite a Mixture of Carbonic Oxide and Oxygen at Atmospheric Pressure.

The second line of investigation which Mr. Weston took up with me was to study experimentally how the ignitibility of a mixture of carbonic oxide and oxygen in combining proportions is affected by progressively drying it.

Some years ago, Prof. W. M. Thornton showed that, for given sparking conditions (*e.g.*, electrodes, type of discharge, voltage, &c.), a certain minimum spark energy is required to ignite a given explosive gaseous mixture; and, in studying the igniting powers of condenser-discharge sparks, which are oscillatory and of extremely short duration, and start with ionization of the gas between the poles, he proved that "there is in every case a well-marked limit to their igniting power." Thus, in the case of a CO-air mixture containing 30 p.ct. of the combustible gas, he found that with a 100-volt condenser discharge a minimum capacity of 2 microfarads was required for ignition.†

It seemed to us that, if the presence of water vapour has any material influence upon the ignitibility of a given explosive mixture of carbon monoxide and oxygen (say, $2CO + O_2$), then the minimum condenser discharge spark-energy required to ignite it ought to vary according to the amount of water vapour present; so that, on progressively drying such a mixture from a condition of (say) "saturation" at room temperature to one which is in equilibrium with a fairly efficient drying agent, as, for example, freshly-ignited calcium chloride, the minimum spark-energy required for ignition should progressively increase, until at length it becomes many times greater than ordinarily it is.

On putting the matter to the test of experiment, our anticipation proved to be correct, the minimum spark energy required to ignite a calcium-chloride-dried $2CO + O_2$ mixture being some thirty times greater than for the same mixture when saturated with water vapour at the room temperature.

Our experimental procedure has been fully described in a paper recently published by us in the Proceedings of the Royal Society (A. Vol. 110, pp. 615 to 634). Briefly, it consisted in determining the minimum condenser discharge spark-energy required to ignite a mixture of highly purified carbonic oxide and oxygen, in varying hygroscopic states, contained in a special glass explosion vessel (similar to the one shown in fig. 4) which was fitted with stout platinum electrodes. A number of condensers of known capacity, which had been previously calibrated by means of a ballistic galvanometer and a 1 microfarad standard condenser, were charged from the mains up to 110 volts, as verified by an electrostatic voltmeter. The condensers were connected up with the electrodes of the explosion vessel through a double-pole double-throw switch; and by gently tilting the explosion vessel the gap between the electrodes was reduced until the condenser discharged across it.

To begin with, a capacity was used well below that required to ignite the particular mixture under investigation, and a trial was made. The capacity was then gradually increased, in steps of 0·1 or 0·25 microfarad, until a point was reached at which the mixture was fired by the discharge-spark. Three trials were given at each successive capacity before increasing it; and whenever several trials were necessary before reaching the "limiting" capacity, a special redetermination of the latter was made. Every precaution was taken to keep the electrodes perfectly clean throughout a given series of experiments; indeed, the whole elaborate cleaning operation previously referred to was repeated after every three or four ignitions. The results obtained were as follows:

| — | Hygroscopic Condition of $2CO + O_2$ Mixture. | | Minimum Igniting Capacity at 110 Volts Microfarads. | Energy of Minimum Igniting Spark. $\frac{1}{2}CV^2$ = Joules × $10^8/10^6$. |
|---|---|---|---|---|
| | Saturated with Aqueous Vapour at °C. | P.Ct. $H_2O$ by Volume Present. | | |
| Mixture "saturated" at room temperature | 17·4° | 2·00 | 0·76 | 4,600 |
| | 17·0° | 1·98 | | |
| | 14·5° | 1·70 | 0·83 | 5,020 |
| | 14·0° | 1·60 | 0·98 | 5,930 |
| Mixture "saturated" at a low temperature controlled by ice or some freezing mixture | 4·0° | 0·80 | 4·00 | 24,200 |
| | 0·00° | 0·60 | 4·80 | 29,040 |
| | − 5° | 0·40 | 8·00 | 48,400 |
| | −10° | 0·26 | 10·07 | 60,900 |
| | −16° | 0·16 | 17·25 | 104,350 |
| | −25° | 0·06 | 18·79 | 113,800 |
| Mixture | $CaCl_2$ dried | 0·03 | 20 83 | 126,000 |

The results, which are plotted on the graph shown in fig. 2, are all seen to fall very near to a smooth curve. They prove that, as the water vapour is progressively removed from a $2CO + O_2$ mixture, its ignitibility by condenser discharge sparks rapidly diminishes, the minimum spark energy necessary to fire it increasing until with a calcium chloride-dried mixture it becomes something between twenty and thirty fold as great

† "Roy. Soc. Proc.," A, vol. 90, pp. 272-297 (1914); vol. 91, pp. 17-22 (1914); vol. 92, pp. 9-22 and 381-401 (1915-16).

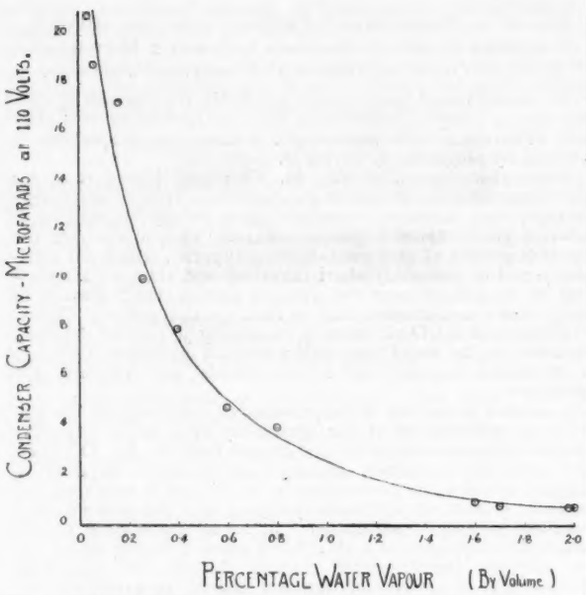


**Fig. 2.—Ignition Energies (Condenser Discharge Sparks) for $2CO + O_2$ Mixtures under Varying Hygroscopic Conditions.**

as that required to ignite the same mixture when " saturated " with moisture at the room temperature (14° to 17·5° C.).

It is known that the discharge of a condenser, by bringing together wires attached to its terminals, is characterized by extreme rapidity, the first oscillation being completed in less than a millionth of a second. Its effects are certainly " impulsive; " the spark starts with collision-ionization of the gas between the poles, which rises to a maximum in the first oscillation. Presumably it also has a high temperature, and gives rise to high local gas pressure, as is evident from the sharp crackling sound emitted. As the result of recent (unpublished) experiments, we have, however, satisfied ourselves that the " compression wave " set up in the gaseous mixture when the discharge is passed plays no part in the ignition, which presumably is due to " ionization " of the gases by the spark. So that the foregoing experiments would seem to prove that the progressive drying of a mixture of carbonic oxide and oxygen necessitates an increasingly powerful " ionizing " spark for its ignition.

### Proof that a Rigidly-Dried Mixture of Carbonic Oxide and Oxygen can be Exploded at Atmospheric Pressure by a Sufficiently Powerful Condenser Discharge.

The third step in our experimental inquiry was to ascertain whether or not an explosive $2CO + O_2$ mixture which had been rigidly dried by prolonged exposure to phosphoric anhydride can be exploded by a sufficiently powerful condenser discharge. For this purpose, it was necessary to adopt special precautions in order to ensure, not only the utmost cleanliness in the explosion vessels used, but also the most efficient drying possible of the gaseous mixture, and its absolute freedom from all impurities.

This involved a very elaborate experimental ritual, with the details of which I need not trouble you, particularly as they are fully described in our Royal Society paper (*loc. cit.*). The apparatus employed for the preparation and purification of the gases, their admixture in the desired proportions, and the preliminary drying by means of redistilled phosphoric anhydride and liquid air, is shown in fig. 3. It was constructed in one piece throughout, all joints in it being of fused glass; all the five stopcocks included in it were lubricated with syrupy phosphoric acid, because it was absolutely necessary to avoid the use of any organic lubricant.

The experimental mixture of the two gases in their combining proportions ($2CO + O_2$) having been made in the graduated glass burette F over dry redistilled mercury, it was subsequently transferred to each of four glass explosion vessels L in the following manner: The whole of the apparatus to the right of F was, first of all, thoroughly exhausted down to 0·01 mm. through the tap *d* by means of a Hyvac pump, which was kept continuously running for at least 24 hours, and in some cases for three or four days. During this period the explosion vessel was several times strongly heated externally with a naked bunsen flame to ensure the removal, as far as possible, of any moisture film still adhering to its walls. Finally, the tap *d* having been closed, the gaseous mixture was very slowly passed, at a rate between 0·5 and 1 c.c. per minute, from the gas burette F, through the drying system to the right thereof, into the explosion vessel L. This drying system comprised (i) a glass spiral G immersed in a bath of liquid air, and (ii) two tubes H and K, altogether 100 cm. long, filled with pure redistilled phosphoric anhydride. Also, a quantity of similarly purified phosphoric anhydride had been previously introduced into the lower part of the explosion vessel L through its side tube *e*. As soon as the manometer M, which was connected with the system through the $P_2O_5$-filled guard-tube N, indicated that the explosion vessel L was full of the gaseous mixture at a pressure of about 10 mm. below the barometric at the time, a blowpipe flame was applied at the constriction *θ*, previously made in the glass capillary leading into the explosion vessel, and its contents sealed off in the usual manner.

Four such explosion vessels (see fig. 4), each of about 100 c.c. capacity and containing pure re-distilled phosphoric anhydride in their lower limbs, having thus been filled with the liquid-air- and $P_2O_5$-dried $2CO + O_2$ mixture at the room temperature, and a pressure of about 740 mm., each was put aside in a dark place for a period of six months, in order to ensure as complete a drying of the gaseous mixture as possible in contact with the phosphoric anhydride. During this " drying period " the lower limb of each vessel was frequently tapped in order to expose a fresh $P_2O_5$ surface to the gaseous mixture. Also, once every fortnight all parts of each vessel down to the side tube were externally heated to about 175° C. by means of a specially designed electric heater, in order to disperse and get rid of any " moisture-film " adhering to the inner walls, care being taken to screen the $P_2O_5$ in the lower limb from the effects of the heating.

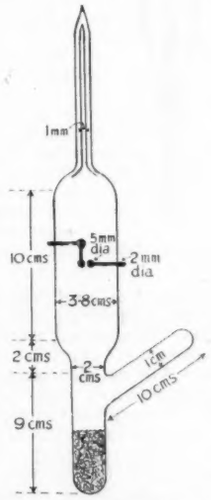


**Fig. 4.—Explosion Vessel.**

*The Explosion of the Rigidly-dried $2CO + O_2$ Mixtures.*—Altogether, four bulbs containing $P_2O_5$-dried $2CO + O_2$ mixtures were prepared in the manner just described, and after a six-months' drying period their ignitibilities by the said con-

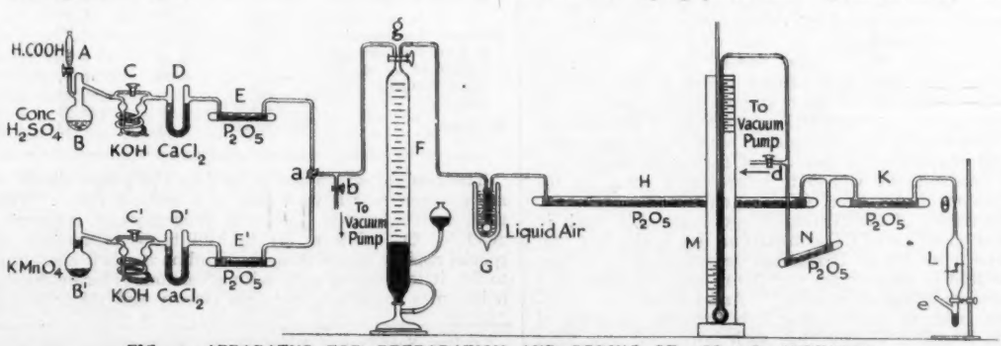


**FIG. 3.—APPARATUS FOR PREPARATION AND DRYING OF $2CO + O_2$ MIXTURES.**

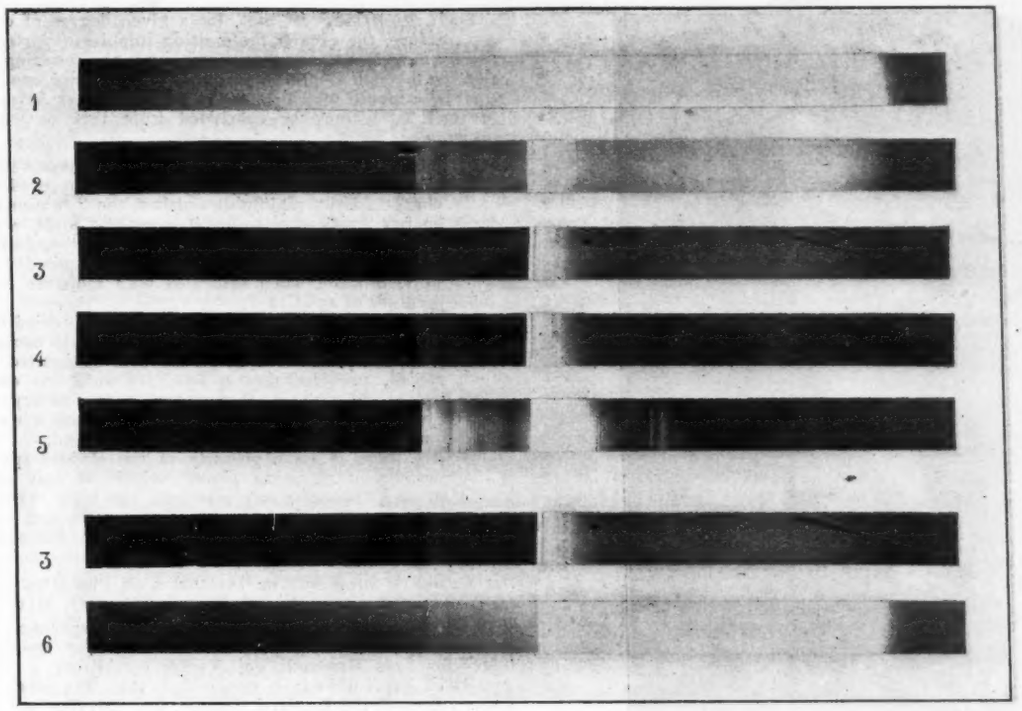


PLATE I.

denser discharge were tested. The general result was that, whereas ignition could not be effected with a condenser capacity of 0·5 microfarad—*i.e.*, with a "spark energy" of less than about 0·235 Joule, at the aforesaid voltage, it always occurred instantly, and at first shot, with a condenser capacity of 0·77 microfarad or more—*i.e.*, a spark energy of 0·362 Joule, or more.

Some idea of how powerful a spark was needed to ignite the mixtures may be gathered from the estimate of Captain Finch, who was in charge of the firing arrangements, that in the circuit employed the peak current of the first oscillation of the discharge spark from a 0·75 microfarad condenser at 970 volts would be certainly not less than 700 amperes, and possibly many times more. Moreover, it should be stated that when the discharge from a 0·5 microfarad condenser failed to ignite the mixtures, the spark simply passed across the gap between the electrodes without any sign whatever of a "halo" or such-like appearance.

*In all four cases, with a spark energy of 0·362 Joule or more, the mixture was instantly ignited at first shot, the resulting explosion spreading with a brilliant flame fairly rapidly through the containing vessel.* Judging, however, from sound and appearance, the explosions never seemed to be quite so "sharp" as they were in similar bulbs with an "undried" or even a "$CaCl_2$-dried" $2CO + O_2$ mixture; and the combustion was never, in fact, quite complete, there always being a small residue of uncombined combustible mixture left.

The explosion of No. 1 mixture was effected at first shot with a "spark energy" of 0·47 Joule (1 microfarad at 970 volts) after two previous failures, at several hours intervals, with "spark energies" of 0·052 and 0·235 Joule (0·11 and 0·5 microfarad at 970 volts respectively). The flame spread throughout the mixture more rapidly than the eye could follow, the powdery, phosphoric anhydride in the lower part of the vessel being violently thrown up by the explosion, some of it as high as the electrodes. Subsequent analysis of the products showed that the combustion had been 77·2 p.ct. complete.

The explosion of No. 2 mixture, which was effected at first shot with a "spark energy" of 0·94 Joule (2 microfarads at 970 volts), was witnessed by Profs. H. E. Armstrong and A. Smithells, Sir Robert Robertson, and others; that of No. 3 mixture was carried out in the presence of Prof. H. B. Baker at first shot with a "spark energy" of 2·35 Joules. In each of these cases, a brilliant flame quickly filled the vessel, and subsequent analysis of the products showed the combustion to have been about 88 p.ct. complete.

The explosion of No. 4 mixture was effected at first shot with a "spark energy" of 0·362 Joule (0·75 microfarad at 970 volts) after a previous failure three days before with a "spark energy" of 0·235 Joule only (0·5 microfarad at 970 volts). The flame spread rapidly throughout the mixture, and a photograph of the explosion (which is reproduced in Plate II.) showed that it had completely filled the vessel. Subsequent analysis of the products showed the combustion to have been about 74·3 p.ct.

TABLE I.—*Showing Results of Experiments upon the Explosion of the $P_2O_5$-dried $2CO + O_2$ Mixtures*

| No. of Experiment. | Percentage Composition of the Gaseous Mixture. | | | Explosion Vessel Filled at: | | Drying Period Weeks. | Details of Firing Trials. | Final Pressure (corrd.) of Cold Products mm. | Ratio $P_2/P_1$. | Percentage Composition of the Gaseous Products. | | | | P Ct. CO Burnt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO. | O. | $N_2$. | T°C. | mm. | | | | | $CO_2$. | CO. | $O_2$. | $N_2$. | |
| 1 | 65·9 | 33·4 | 0·7 | 18·5° | 744·2 | 25 | (i) With 0·11 microfarad at 970 volts. $\Sigma$ = 0·052 Joule. *No ignition.* (ii) With 0·50 microfarad at 970 volts. $\Sigma$ = 0·235 Joule. *No ignition.* (iii) With 1·0 microfarad at 970 volts. $\Sigma$ = 0·47 Joule. *Instant Explosion.* | 544·0 | 0·73 | 66·7 | 19·8 | 11·8 | 1·7 | 77·2 |
| 2 | 65·6 | 33·4 | 1·0 | 17·0° | 738·7 | 27 | With 2·0 microfarads at 970 volts. $\Sigma$ = 0·94 Joule. *Instant Explosion.* | 527·0 | 0·715 | 81·5 | 11·1 | 5·5 | 1·9 | 88·0 |
| 3 | 65·8 | 33·5 | 0·7 | 16·5° | 741·0 | 31 | With 5·0 microfarads at 970 volts. $\Sigma$ = 2·35 Joules. *Instant Explosion.* | 526·0 | 0·71 | 80·8 | 11·7 | 5·9 | 1·6 | 87·5 |
| 4 | 66·2 | 33·0 | 0·8 | 19·0° | 733·5 | 24 | (i) With 0·5 microfarad at 970 volts. $\Sigma$ = 0·235 Joule. *No ignition.* (ii) With 0·77 microfarad at 970 volts. $\Sigma$ = 0·362 Joule. *Instant Explosion.* | 551·5 | 0·75 | 64·0 | 22·2 | 11·8 | 2·0 | 74·3 |

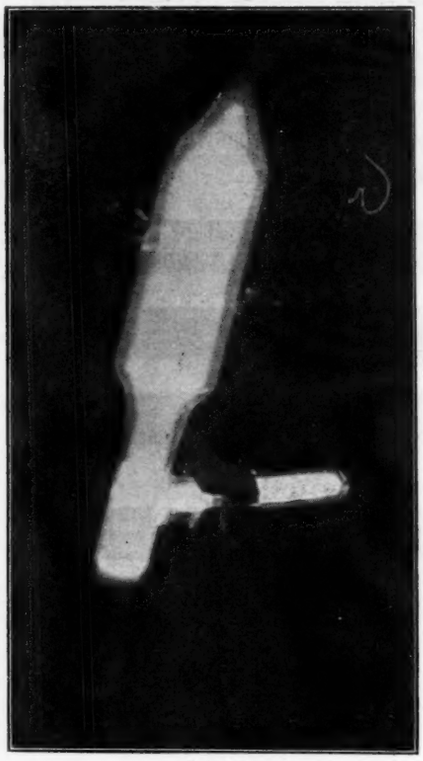

**Plate II.**

complete. Full particulars of these experiments are set out in Table I.

It would thus appear that the minimum condenser "spark energy," at 970 volts, required to ignite such $P_2O_5$-dried mixtures as the foregoing probably lies somewhere between 0·235 and 0·362 Joule. It is also evident that, at such extremes dryness, even when the "spark energy" is sufficient to ignite the gaseous mixture, and the resulting flame spreads rapidly throughout it, its resistance to combustion is still so great that an appreciable amount of it remains unburnt. Thus it was always noticed that the explosions were comparatively "soft" ones, no "click" being audible in any of them; and the incompleteness of the combustions indicated a "reluctance to burn," as though the flame was rather deficient in self-igniting power.

Attention is directed to the fact that in the four experiments under consideration, the greater the energy (up to a limit) of the spark which ignited the mixture, the more complete was the combustion in the subsequent explosion, thus:

| Energy of the Spark Causing Ignition. Joule. | P.Ct. Combustion. |
|---|---|
| 0·362 | 74·3 |
| 0·47 | 77·2 |
| 0·94 } 2·35 } | 88·0 approx. |

In this connection it may be mentioned that in some similar comparative experiments where the $2CO + O_2$ mixtures had been dried for one or two weeks in contact with well-ignited calcium chloride, the minimum condenser spark discharge energy required for ignition seemed to be somewhere between 0·052 and 0·235 Joule (0·11 and 0·5 microfarad, respectively, at 970 volts). The resulting explosions were certainly sharper (a distinct "click" being usually audible) and the combustions more complete than was the case in the corresponding experiments with the $P_2O_5$-dried mixtures.

Such results suggest that, for a given degree of dryness of the mixture, the greater the ionizing impulse imparted to it by the igniting spark, the more complete is the resulting combustion as the flame spreads through the explosive mixture; but this is a point which is reserved for further investigation. Meanwhile, it may be concluded from this section of the research:—

(1) that as water vapour is progressively removed from a $2CO + O_2$ mixture, its "ignitibility" by condenser discharge sparks rapidly diminishes, the "minimum spark energy" necessary to fire it increasing until, with a calcium chloride-dried mixture, it becomes something like twenty or thirtyfold as great as that required to fire the same mixture when saturated with moisture at a temperature of 15° C.;

(2) that a $2CO + O_2$ mixture which has been dried to an extreme degree by prolonged (six months) contact with pure phosphoric anhydride can still be ignited and exploded, provided that a spark of sufficient energy be passed through it, though the gases display a much greater "resistance" to combination than when even a minute amount of moisture is present; and,

(3) that there is some property of the electric spark, presumably its ionizing power, which, if only developed strongly enough, can overcome the high resistance of such an extremely dry mixture to ignition and explosion, and by virtue of which it can, so to speak, compensate the system for the absence of water vapour.

### Experiments Showing the Influence of Pressure upon the Ignitibility of a Rigidly-Dried $2CO + O_2$ Mixture.

While Mr. Weston was engaged upon the experiments which I have just described to you, Mr. R. P. Fraser, the holder of the other Gas Research Fellowship, established a year ago by Radiation Limited in connection with the work of my Department of the Imperial College, was carrying out another series with the object of elucidating the influence of pressure upon the ignitibility by electric sparks of a rigidly-dried mixture of carbonic oxide and oxygen in their combining proportions. And for the sake of completeness, I would like briefly to indicate the nature of the results obtained. It was shown that, with a spark across a 1/100 in. gap from a 1-in. Marconi induction coil, with a current of 6 volts in the primary circuit, a rigidly-dried and highly-purified mixture of carbonic oxide and oxygen could not be ignited at atmospheric pressure, no matter how many sparks were passed. On increasing its pressure to 3 atmospheres, the mixture was fired after several unsuccessful attempts, albeit the resulting combustion was only 90 p.ct. complete. With an initial pressure of 5 atmospheres, or more, the mixture could always be fired at first attempt, though the resulting combustion was never complete unless the initial pressure exceeded 10 atmospheres or thereabouts, as the following experimental data show:

| Experiment. | | Initial Pressure. Atmospheres. | Result. | P.Ct. Combustion. |
|---|---|---|---|---|
| With a $2CO + O_2$ mixture direct from a year in contact with redistilled phosphoric anhydride | 1 | 1·0 | Could not be ignited | — |
| | 2 | 1·5 | | — |
| | 3 | 3·0 | Fired after many attempts | 90·1 |
| | 4 | 5·0 | Always fired at first attempt | 93·4 |
| | 5 | 10·7 | | 99·1 |
| | 6 | 19·0 | | 99·3 |

It thus appears that pressure will overcome the reluctance to burn of a rigidly-dried mixture of carbonic oxide and oxygen, a result which suggested that at high initial pressures the two gases will readily combine without any chemical intervention of steam at all.

### Spectrographic Evidence from Explosions of Well-Dried CO-Air Mixtures under Pressure.

This last-named deduction has been experimentally verified in our laboratories by Dr. D. M. Newitt in the following most conclusive manner. He exploded a well-dried CO-air mix-

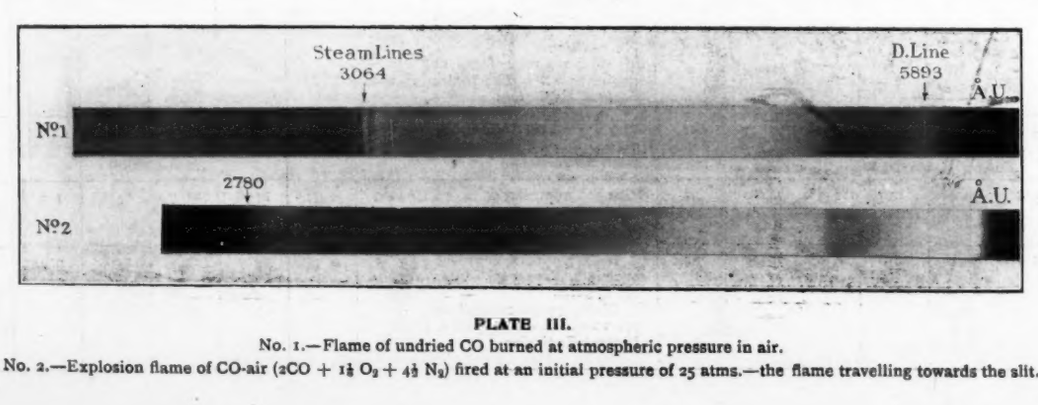


**PLATE III.**

No. 1.—Flame of undried CO burned at atmospheric pressure in air.

No. 2.—Explosion flame of CO-air ($2CO + 1\frac{1}{2} O_2 + 4\frac{1}{2} N_2$) fired at an initial pressure of 25 atms.—the flame travelling towards the slit.

ture, of composition $2CO + 1\frac{1}{2}O_2 + 4\frac{1}{2}N_2$, at an initial pressure of 25 atmospheres, in a cylindrical steel bomb (previously well dried-out) fitted at each end with a quartz window, and, by means of a Hilger No. E2 quartz spectrograph placed in position outside one end of the explosion chamber, he took a photo-spectrogram of the resulting explosion flame advancing in a direction towards the slit of the spectrograph. This spectrogram (Plate III., No. 2) showed a continuous and diffused band-spectrum extending up to 2780 AU in the ultra-violet without any "steam line" being discernible. Above it is reproduced, for comparison, a spectrogram (No. 1) obtained in a preliminary experiment with the same Hilger E2 instrument, of the flame of *undried* carbon monoxide burning at a jet in air at atmospheric pressure, the same amount of the gas being so burnt as was subsequently exploded in the bomb. It will be observed that, while the spectrogram (No. 1) of the *undried* CO-flame at atmospheric pressure extended up to 2700 AU in the ultra-violet, and showed unmistakably the "steam lines," in the region 3060 AU, due to radiations excited by CO and $OH_2$ interactions, as well as the continuous and diffused band-spectrum, due to radiation excited by *direct* CO and $O_2$ interactions, the corresponding spectrogram (No. 2) of the explosion flame of the well-dried CO-air mixture burning in the bomb under pressure is foreshortened in the ultra-violet and exhibits no "steam line" at all, a result of the highest significance.

### Concluding Remarks.

Having now reached the end of my story, I will ask your kind indulgence for a moment longer to summarize what I think may be concluded from the experiments in which your Gas Fellow, Mr. Weston, has so ably collaborated with us during the past three years.

In the first place I think the new facts which have emerged from the inquiry have proved beyond any reasonable doubt that *the presence of steam is not essential to the ignition and explosion* of carbonic oxide and oxygen mixtures, as has hitherto been previously supposed, but that the two gases can and do combine directly without its intervention.

Secondly, the spectrographic evidence shows that when *undried* carbon monoxide is burnt at a jet in undried air (or oxygen) at ordinary pressures, both the *direct* and *indirect* ixidations undoubtedly go on simultaneously and independently; also, that it is the radiations excited by the *direct* CO-oxygen interactions in the flame which give rise to the continuous and banded parts of its spectrum, whilst the "steam lines" are due to radiations excited by the $CO\text{-}OH_2$ interactions.

Thirdly, it has been proved that an increasingly high pressure undoubtedly favours the *direct* oxidation, so that at high initial pressures it predominates to the exclusion of the *indirect;* on the other hand, the presence of hydrogen in the burning mixture undoubtedly favours the *indirect* oxidation, so that in a water-gas flame at ordinary pressure the indirect predominates to the practical exclusion of the direct, and the character of the radiation emitted is modified accordingly—a most important consideration in its bearing upon the practical uses of water-gas, and other mixtures of carbonic oxide and hydrogen. Indeed, it may now be said that the characteristic radiation emitted by a flame, in which the combustible gas is carbonic oxide only, is rapidly eliminated when hydrogen is added to the burning gas; because, as the hydrogen content thereof increases, the more are the *direct* CO-oxygen interactions superseded by the *indirect* $CO\text{-}OH_2$ oxidations, until, when a "water-gas" composition is reached, such supersession is practically complete, with the result that, so far as the character of the radiation emitted from it is concerned, a "water-gas" flame is, to all practical intents and purposes, a "hydrogen" flame.

Finally, although possibly this is a point more of theoretical than of immediate practical interest, the results of the investigation undoubtedly show that, while steam plays no *essential* rôle *chemically* in the combustion of carbonic oxide, the presence of a minute amount of it does in some way or other, presumably *physically*, help to overcome the extreme reluctance of the *dry* gas to burn. How it so acts is not yet known, and therefore is a matter of speculation only; but we are continuing the investigation in the hope of arriving in time at a true explanation. If, however, I had to hazard an opinion at this moment, I would be inclined to say that it seems likely to be found in the "ionization" of one (or both) of the combustible gases, as a necessary precedent to their combustion, which the presence of even a minute quantity of steam would assist by retarding the recombination of negative particles with positively charged CO molecules.

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Mr. Milne Watson, on behalf of those present, expressed appreciation of the lecture and of the experiments which had accompanied it. As Governor of the Gas Light and Coke Company, he felt the Company had been amply rewarded for what they had done in founding the Gas Fellowship. They had been able to see the vast amount of work which had been undertaken by Mr. Weston; and he (the speaker) hoped that the next Gas Fellow would carry out equally valuable investigations.

Prof. H. E. Armstrong, seconding the vote of thanks, congratulated the lecturer and the Company on the honour they had paid to carbon monoxide. Prof. Bone had done really remarkable work on the subject of explosions, though he (Prof. Armstrong) did not wholly agree with the lecturer's conclusions. Before they understood the combustion of carbon monoxide, they would have to know far more about the fundamental problem of chemical charge. In his opinion carbon monoxide could not be regarded as an explosive gas *per se*. The heat of combustion of hydrogen was 326·8 B.Th.U. per c.ft., and that of carbon monoxide 324 B.Th.U. This certainly was only a small difference, but to his mind it was sufficient to make valid his statement that carbon monoxide was not explosive with oxygen, and that its energy had to be raised to 326 B.Th.U. before it would explode. In a hydrogen-oxygen carbon monoxide-oxygen mixture, the exploding spark perhaps resulted in the formation of $H_2O_2$ having a potential of sufficient magnitude to bring about the explosion of the carbon monoxide. The whole question would probably not be settled by purely experimental means. Its solution, he thought, was beyond the scope of the laboratory alone. Prof. Armstrong concluded his remarks by saying that, on problems of gaseous combustion, the experimental skill and accuracy of Prof. Bone could not be matched anywhere.

The meeting terminated with a vote of thanks to Mr. Milne Watson and the Court of Directors of the Gas Light and Coke Company, proposed by Mr. H. J. Yates, the Chairman of Messrs. Radiation Limited.

## Gas-Fired Annealing.

In a paper presented to the Gas Section of the Wisconsin Utilities Association, Mr. G. H. Head (of the Wisconsin Gas and Electric Company, Racine) stated that the Belle City Malleable Iron Company, of Racine, are one of the outstanding users of gas on a large scale. All their castings are annealed and their cores baked with gas. The annealing is done continuously in a Dressler tunnel kiln which is 347 ft. long, and has a capacity of 60 tons of castings every 24 hours. The hard iron castings are placed in cast-iron pots, sealed, and loaded on to trucks, which are periodically pushed into the receiving end of the kiln, thus advancing the whole train of loaded cars and discharging a finished truck load at the other end. From five to ten days is required for the trip through the kiln, depending upon the number of trucks being loaded daily. A refractory muffle on each side of the kiln extends from the middle portion to the receiving end; and through this the products of combustion pass. Upon leaving the kiln, the products go through a heat exchanger, which pre-heats the air for combustion supplied by a turbo blower at a constant pressure. The gas is taken from a high-pressure line, and the pressure reduced and held constant within 1-10th in. water pressure at all times by means of two regulators in series. The operation of the kiln is remarkable for the extremely close control of temperature and combustion efficiency. The operators are able to tell at a glance by the appearance of the flame whether the proper mixture is being supplied; and this is checked frequently by $CO_2$ determinations. It is not at all uncommon, with a steady load on the kiln, to operate several days without any change in the conditions of combustion, and without a temperature variation greater than 10°.

## Oil-Operated Remote Control Valve.

A remote control valve of the Western Gas Construction Company, Fort Wayne (Ind.), which is described and illustrated in the "Gas Age-Record," operates with oil pressure, electrically controlled. The valve is opened and closed with oil, which is pumped into the cylinder with a small rotary pump directly connected to a motor. The control equipment consists of a reversing switch, two pressure switches interlocked, and an "open-closed-stop" push-button station. The energizing coil on the reversing switch is connected through the contacts on the pressure switch so that, when one switch is opened, the other is closed. The coil is also connected to the push-button stations. In order to open the valve, the "open" button is depressed. Oil is pumped from the top of the valve cylinder into the bottom, thus forcing up the piston and opening the valve. When the valve is open, it builds-up the pressure on the pressure switch, opening the energizing circuit, opening the reversing switch, and, because of the interlocking features on the pressure switches, closing the pressure switch contacts on the closing side of the valve. To close the valve, the "closed" button is pressed, the oil is pumped from the bottom of the valve cylinder to the top, and the piston is forced down, closing the valve. The valve becomes seated, builds-up pressure, opens the pressure switch, and thus stops the motor. The "opened" pressure switch is placed in position for operating when it is desired to open the valve.

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**Books Received.**—We have received from Messrs. Chapman and Hall a book on "Coal and Ash Handling Plant," by John D. Troup, M.I.Mech.E. The price is 13s. 6d. net. We hope to call attention to its contents in an early issue.

# OIL FROM COAL.

By HARALD NIELSEN.

(*Concluded from p.* 653.)

From a study of Tables IV. (B) and IV. (D), it would appear as if the Bergius process is essentially a pressure cracking process, and that the cyclic compounds are subjected to changes of a similar nature as in the ordinary oil cracking processes, where an oil originally injected is converted into a range of lighter oils with a higher percentage of hydrogen, and a range of heavier oils with less hydrogen percentage than that of the original oil, accompanied by gas evolution (hydrogen and methane principally) as well as deposition of free carbon. It is difficult to distinguish between the free carbon and the unconverted coal substance in the Bergius bomb effluent, so that it cannot be definitely stated that free carbon as such exists in the crude oil. In other words, the primary products take the place of the injected oil. The comparison of the " L & N " neutral fractions with the Bergius corresponding fraction—Table IV. (A) and Table IV. (B)—is highly instructive. See also Annexe I.

On the other hand, it is doubtful if more liquid products, as such, are formed in the Bergius bomb than would normally be set free from the coal substance by direct distillation; but very likely the coal substance, or a great part of it, is converted into a complex unsaturated body which is soluble in the oil previously added to the finely ground coal, or the " carrier " for same, and that this complex body, during the subsequent fractionating and rectifying of the Bergius oil, is cracked up and collected as the various fractions we find. That the Bergius oil is of a highly unstable character is evident from the fact that on collecting the fractions up to 193° C. (15 mm. Hg. *plus* superheated steam) and redistilling same in vacuum (15 mm. Hg.) up to 230° C., a pitchy residue, 10·5 p.ct. by weight of the oil redistilled, is left in the still, and a loss of 6·9 p.ct. by weight is registered.

There is some justification for the assumption that the Bergius process is a cracking process, when Prof. W. Bone's benzene extractions from bituminous coals are considered (see above).

Take Table VIII., based on his work:

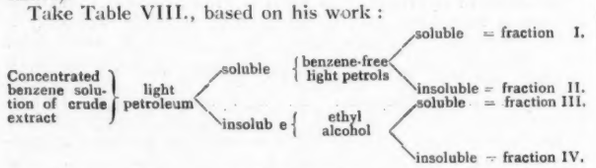


TABLE VIII.

| | |
|---|---|
| Fraction I. . | A non-nitrogenous heavy oil. |
| ,, II. . | A red-brown solid, softening-point about 25° C. |
| ,, III. . | Non-nitrogenous brittle resinous red-brown solid, softening-point about 60° C. |
| IV. . | Nitrogenous amorphous brown solid, softening-point 180° to 230° C. |

The percentages of the various fractions on the weight of the extract from the Barnsley bed coal, for instance, are:

| | P.Ct. |
|---|---|
| Fraction I. = | 26·5 |
| ,, II. = | 7·24 |
| ,, III. = | 4·81 |
| ,, IV. = | 61·45 |

Furthermore, from facts and figures which have been set out above, it is evident that with the correct distillation methods of coal, liquid products can be obtained which can take the place of well-oil derivatives to a far greater extent than those produced by the Bergius method.

The demand is continuously increasing for light oils—motor fuel in particular. Without going into costs of production, but dealing with the aspect from the purely technical point of view, the Bergius process can no doubt supply light oils, but it must be remembered that there are other products of prime importance to be considered as well—namely, the lubricants.

Franz Fischer's and Hans Tropsch's " Synthol " process, in conjunction with coal distillation, seems to be the ideal solution of the problem of how to obtain oil from coal.

Fischer and Tropsch prefer to start with solid carbonaceous residue from the coal distillation. This material can either be hydrogenated [see Kling and Florentin, *Comptes Rendus* 182, pp. 389 and 526 (1926)] or be converted into CO and $H_2$—that is, plain water gas. Fischer and Tropsch do the latter. At temperatures just over 400° C. (410° C. was used in some interesting tests at Mulheim) and at 100 to 150 atmospheres pressure, a reaction product was obtained which consisted principally of:

| | P.Ct. |
|---|---|
| Organic acids . . . . . | = 10 |
| Alcohols, Aldehydes and Kentones . . . . . | = 29 |
| Lighter oils . . . . . | = 48 to 50 |
| Oily substances, which were miscible with water . . | = 10 to 11 |

According to Fischer's book, referred to above, the synthol obtained from the water gas reaction in a tinned iron tube and under the above conditions had the following properties (see Table IX.):

TABLE IX.

| Fraction. | P.Ct. by Weight. | Specific Gravity. | Ultimate Analysis. | | |
|---|---|---|---|---|---|
| | | | P.Ct. C. | P.Ct. H. | P.Ct. O. |
| 72° to 80° C. | 12·5 | 0·7895 | 67·02 | 11·25 | 21 73 |
| 80° to 100° C. | 22·0 | | | | |
| 100° to 150° C. | 28·5 | 0·8440 | | | |
| 150° to 200° C. | 18·0 | | | | |
| 200° to 250° C. | 12·0 | 0·9636 | | | |

Practically the whole of the synthol (over 80 p.ct.) can be used for motor spirit.

A series of road tests was carried out in order to compare synthol with benzole. The refined synthol had the following properties (see Table X.).

TABLE X.

| Fraction. | P.Ct. by Weight. | General Properties of Spirit. |
|---|---|---|
| 62° to 80° C. | 11·0 | Specific gravity D = 0·8289 |
| 80° to 100° C. | 26·0 | Gross cal. val. = 14,800 B.Th.U. per lb. |
| 100° to 120° C. | 27·0 | Net cal. val., 13,600 B.Th.U. per lb. |
| 120° to 140° C. | 12·0 | Solidifying point, −90° C. |
| 140° to 160° C. | 8·0 | Carbon, 69·26 p.ct. |
| 160° to 180° C. | 7·0 | Hydrogen, 12·25 p.ct. |
| 180° to 200° C. | 6·0 | Solubility in conc. $H_2SO_4$, almost complete |
| above 200° C. | 3·0 | |

| | |
|---|---|
| Kilometres run per 100 c.c. | synthol = 3·0 |
| ,, ,, ,, 100 c.c. | benzole = 2·9 |
| ,, ,, ,, 50–50 synthol-benzole | = 3·2 |
| Specific gravity of benzole used | = 0·8790 |
| Calorific value of benzole used | = 17,250 B.Th.U. net per lb. |

Taking the very considerable difference in calorific values into consideration, the results obtained with the synthol are most remarkable, and will be even more so when compared with petrol.

When the synthol fractions above 100° C. boiling point are subjected to high-pressure treatment and temperatures *circa* 450° C. in bombs or autoclaves, a change takes place. Gas and different oils are obtained. The latter amount to about 70 p.ct. of the original synthol. This new oil is soluble in concentrated $H_2SO_4$ to the extent of 50 p.ct. only, as against nearly 100 p.ct. with synthol.

Table XI. gives the fractionation of this new oil.

TABLE XI.

| Fraction. | P.Ct. by Volume. |
|---|---|
| 50° to 100° C. . . . . | 17 0 |
| 100° to 150° C. . . . . | 18·0 |
| 150° to 200° C. . . . . | 22·0 |
| 200° to 250° C. . . . . | 17·0 |
| 250° to 300° C. . . . . | 10·0 |
| Balance . . . . . | 16·0 |

The oil fraction insoluble in $H_2SO_4$ was refined, and had the following properties (see Table XII.).

TABLE XII.

| Fraction. | P.Ct. Carbon. | P.Ct. Hydrogen. | Specific Gravity $D^{20}$ | Fraction. | P.Ct. by Volume. |
|---|---|---|---|---|---|
| Up to 50° C. | 84·12 | 15·44 | .. | .. | .. |
| 75° to 100° C. | 84·48 | 15·14 | 0·7620 | 120° to 150° C. | 24·0 |
| 100° to 150° C. | 86·89 | 13·37 | 0·7780 | 150° to 200° C. | 44·0 |
| 150° to 200° C. | 87·74 | 12·67 | 0·8180 | 200° to 270° C. | 27·0 |
| 200° to 270° C. | 88·43 | 12·05 | 0·8740 | Over 270° C. | 5·0 |

The oil fraction soluble in $H_2SO_4$ still contained oxygen. The main fraction, 175° to 235° C.—namely, 67 p.ct. of the total—had 79·05 p.ct. carbon, 11·20 hydrogen, balance oxygen.

By re-circulating the reaction gases, Fischer and Tropsch found that they could obtain 112 c.c. (= 100 grammes) of liquid oil products per cubic metre of water gas. Reckoning a water gas production of 56,000 c.ft. per ton of solid carbonaceous residue, which is a moderate volume easily obtained at present in every-day water gas practice, 0·160 tons, or 40 gallons, of motor spirit, with slight refining losses, are available for direct use. The " Synthol " process is somewhat similar to the Badische Anilin und Soda Fabrik process, both starting from the same raw material—namely, water gas from coal residue. The latter process is working on a very large scale.

Technical improvements are foreshadowed, which in the near future will greatly increase the yield of light oil.

Highly interesting work which has been carried out by Fischer and Tropsch very recently on the water gas synthesis

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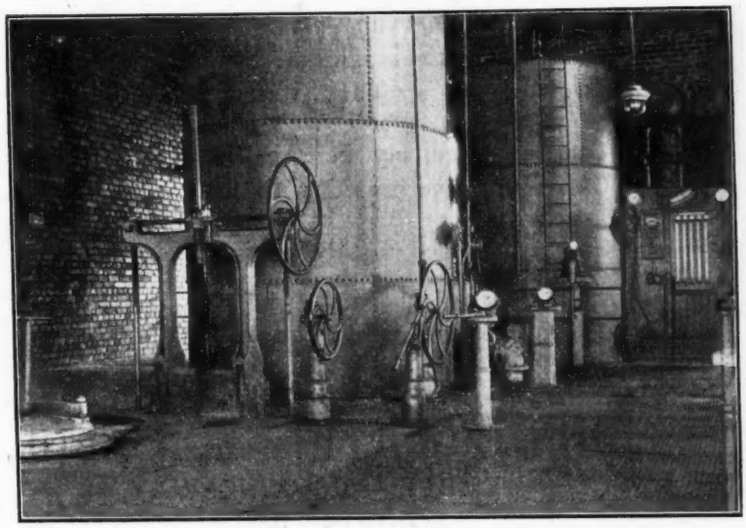

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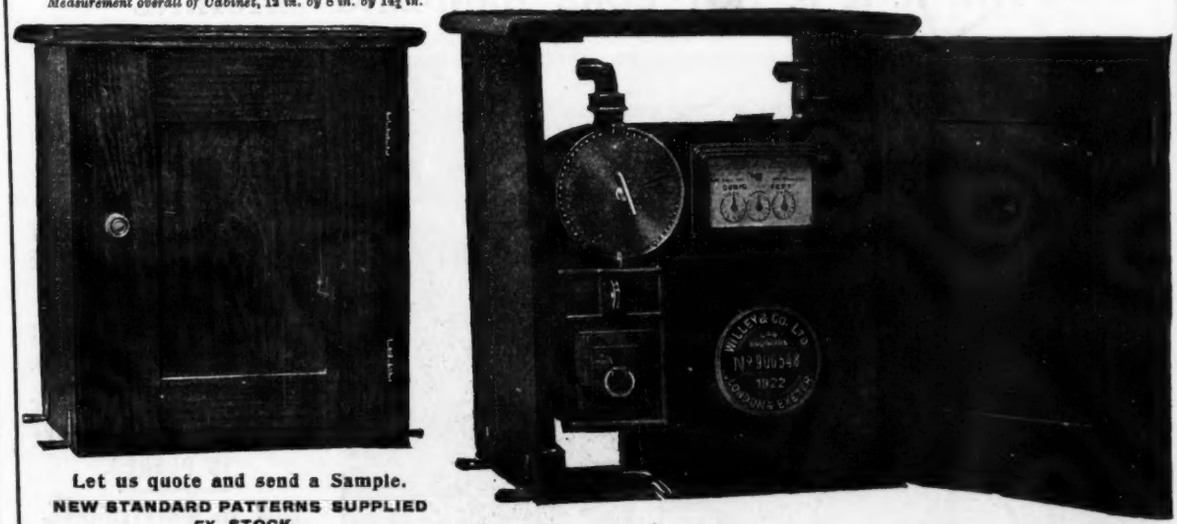

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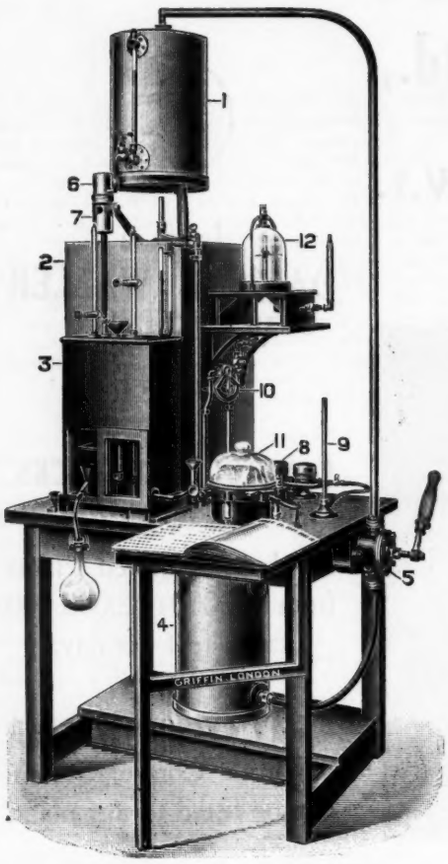


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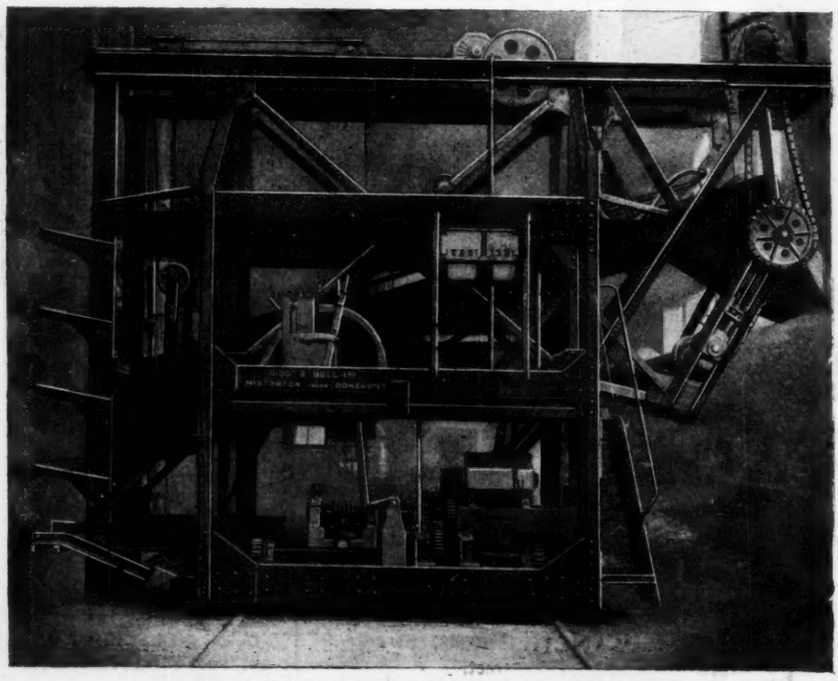

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Of this volume of oil, about 20 gallons are primary distillation oils, and the balance is motor spirits from the solid fuel residue.

### CONCLUSIONS.

*"The future prosperity of this Empire is intimately bound up with the scientific utilization of its fuel resources."*

1. A comprehensive survey on the production of oil from coal by various processes, English and foreign, has been made on the basis of incontestable evidence.
2. The evidence proves that by the scientific treatment of coal, particularly of the lower grades, the value of same can be vastly increased, at the same time affording employment for a far greater number of workers.
3. The evidence proves that only by treatment along specific, clearly defined lines can oil products be made which can take the place of imported well-oil derivatives.
4. The evidence emphasizes the necessity of obtaining the so-called primary oil products as a first stage.
5. From these primary products can be obtained the valuable lubricating fractions. See comparative oil analyses.
6. It is relatively easy to obtain motor spirit and lighter oils, but the heavier lubricating fractions are more difficult to produce. The evidence collected proves this.
7. After careful consideration, the "L & N" process seems at present to be the only one which can be relied upon to furnish proper heavier and lighter lubricating bases (oils).
8. The Bergius process, on which very few positive facts have been known up till recently, does not, according to independent authorities, produce lubricating bases, but only motor spirits and fuel oils.
9. The working-up of the Bergius oil on a large scale has not been done so far. The smaller samples dealt with have been difficult to handle technically (see conclusion under the Bergius section).
10. It has been proved by the "L & N" investigation, and supported by independent authorities, that the possibility exists of producing a uniform standard primary oil product by distillation from average British coals, irrespective of locality or properties of the individual coals.
11. The refining of such oils will not cause unexpected difficulties, and can be made a standard procedure.
12. The underlying principles of distillation which will give the desired products have been elucidated.
13. The production of light oils, spirits, and alcohol from carbon monoxide and hydrogen according to the Fischer-Tropsch-Badische process has been commercially established.
14. Road tests carried out on these spirits prove that they are superior to benzole, and consequently petrol.
15. The ideal process for producing oils from bituminous coal which can meet the demand for every grade of oil will be the "L & N" process for heavier and lighter primary oils, and thereafter the Fischer-Badische for motor spirits from the solid residue over the water gas catalysis, as in this way the largest volume of suitable oils will be produced on the most economical and competitive lines.
16. Finally, a straight coal distillation, such as the "L & N" process, for the production of primary oil, in conjunction with suitable treatment of the solid residue, will meet the oil requirements—such as petrol, light oils, Diesel, fuel oils, and lubricating oils—for many years to come, without the extra expense of liquefying the solid residue by "hydrogenation."

Finally, the writer wishes to express his indebtedness and gratitude to Mr. F. E. Smith, F.R.S., D.S.R. to the Admiralty; Prof. W. A. Bone, F.R.S., of the Imperial College of Science and Technology; Geheimrat Prof. Franz Fischer and Dr. Hans Tropsch, of the Kaiser Wilhelm Institute, Mulheim; Dr. A. Thau, of Stinnes Riebeck Montanwerke; and others, for their kind criticisms and helpful suggestions, as well as to the writer's assistants, Dr. Stanley Baker, Mr. Hamilton Foott, and Dr. G. S. Haslam.

## ANNEXE I.

*Examination of "L & N" Oil from Large-Scale Test on Lambton Coal (Durham).*

**Lambton Oil (Condenser Oil).** (Each percentage is reckoned on anhydrous crude oil.)

Water in crude oil = 3·2 p.ct.

*By Standard Engler Distillation.*

| | P.Ct. |
|---|---|
| 0° to 200° C. | 2·0 |
| 200° to 250° C. | 15·0 |
| 250° to 300° C. | 17·0 |
| 300° to 350° C. | 17·0 |
| 350° to 400° C. | 25·0 |
| Pitch | 19·8 |
| Loss | 4·2=100·0 |

*By Steam Distillation.*

Oil = 84·6 p.ct. Pitch = 11·4 p.ct. Loss = 4·0 p.ct.
Neutral oils = 47·5 p.ct. Acid oils = 37·0 p.ct.

*By Steam Distillation.*

NEUTRAL OILS.

| Temperature in Oil. | Outlet Temperature. | P.Ct. Yield by Weight. |
|---|---|---|
| 200° C. | Not showing | 5·6 |
| 237° C. | " " | 18·5 |
| 267° C. | 190 | 22·5 |
| 300° C. | 202 | 58·5 |
| 331° C. | 232 | 75·5 |
| 370° C. | 265 | 84·5 |
| 405° C. | 285 | 93·5 |
| Coke and loss | .. | 6·5 |

Crude burning oils = 20·7 p.ct.
Crude light lubricating bases = 5·6 p.ct.
Heavy lubricating bases = 18·2 p.ct.
Pitch and loss = 3 p.ct.

Refining and re-distilling crude burning oil—
Fraction 200° to 250° C. = 3·8 p.ct. (Light burning oil.)
250° to 300° C. = 7·7 " } Heavy burning oil or Diesel.
300° to 320° C. = 1·8 " }
Above 320° C. = 3·9 " Light lubricating oil, free burning oil fraction.

Loss on distilling and refining, 3·5 p.ct.

Refining and re-distilling light lubricating oil—
Boiling up to 340° to 350° C. = 5·2 p.ct.
Paraffin wax from same = 0·33 "
Loss on refining = 0·10 "

Refining and re-distilling heavy lubricating oil—
16·74 p.ct. boiling up to and over 400° C.
1·12 " paraffin wax.
Loss = 0·34 p.ct.

Refining the heavy lubricating oil with 10 p.ct. conc. $H_2SO_4$.
Refined oil, 10·3 p.ct. Loss (acid tar), 6·53 p.ct.

*Properties of Lubricating Oils.*

Light lubricating oil viscosity at 70° Fahr. = 115 Redwood seconds
Heavy " " " " 100° " = 1657 " "
" " " " " 140° " = 250 " "
" " " " " 200° " = 58 " "
Flash point, open test method, 365° to 370° Fahr.
Fire point: 435° Fahr.

*Ultimate Analysis of Refined Heavy Lubricating Oil.*

$H_2$ = 9 p.ct. } Oil is therefore a pure hydrocarbon.
C = 89·5 p.ct. }
$O_2$ + loss = 1·5 p.ct. } Calorific value = 9850 kg. cal. per kg. = 17,750 B.Th.U. per lb.

*Specific Gravities of Neutral Oils.*

| | |
|---|---|
| Burning oil, light | 0·864 |
| " " heavy | 0·914 |
| Light lubricating | 1·023 |
| Heavy " | 1·075 |

Fischer test for ascertaining true primary state of crude oil.

Extracted by pure benzene neutral fraction boiling between 200° and 300° C., specific gravity = 0·9045.

(Fischer's upper limit 0·950 for primary oils.)

Loss on heating heavy lubricating base for 30 minutes at 150° C. in the open air 0·7 p.ct. (loss on heating Vacuum Oil Company's heavy "A" oil = 0·6 p.ct.).

ACID OILS.

*Engler Distillation.*

| | P.Ct. |
|---|---|
| 0° to 200° C. = | 2·2 |
| 200° to 250° C. = | 22·0 |
| 250° to 300° C. = | 18·0 |
| 300° to 350° C. = | 10·0 |
| 350° to 370° C. = | 7·8 |
| Balance, thick viscous oil beginning to decompose at 370° to 375°C. | |

Specific gravity of acid oils at 15° C. = 1·040 to 1·045.

A Rideal-Walker test was carried out on two acid oil fractions by two independent outside experts; the results agreeing closely.

Fraction 200° to 300° Rideal-Walker co-efficient 15 to 16
" above 300° " " " 3
(against Bac. Typhosus)

The interpretation of these results is that fraction 200° to 300° has 15 to 16 times the germ-killing power of pure carbolic acid. The phenols boiling between 220° to 270° C. have a still higher germicidal power.

### GENERAL.

The investigations have been carried out on the oils obtained from the condensers, as it is here that the principal differences exist between oil obtained by the "L & N" process and that by other internally or externally heated processes.

It will be found that as a rule the heavy fraction between 350° and 400° or 420° C. obtained by the "L & N" method of distillation, and representing by far the most valuable fraction of the oil (25 to 30 p.ct.)—that is to say, the heavy lubricating oil base—does not exist in other low-temperature oils obtained by other distillation methods; if it exists, it does so only in small quantities.

The heavy lubricating base is extraordinarily stable and resistant to high temperature. The unpurified fraction will, for

instance, stand being heated for four hours at 348° C. = 660° Fahr. without losing more than 1·3 p.ct. No thermal decomposition with the formation of free carbon was observed.

Quantities of refined oils, &c., obtained by distilling one ton of Lambton coal by the "L & N" method:

*20 Gallons of Anhydrous Oil obtained per Ton of Dry Coal.*

| 100 P.Ct. | By Distillation and Refining. | Lbs. | Gallons. | Total Gallons. |
|---|---|---|---|---|
| 3·8 | Light burning oil | 8 | = 0·925 | .. |
| 9·5 | Diesel oil (neutral) | 20 | = 2·190 | .. |
| | Total neutral burning oil | .. | .. | 3·115 |
| 9·1 | Light lubricating oil | 19·1 | = 1·890 | .. |
| 10·3 | Heavy lubricating oil | 21·6 | = 2·020 | .. |
| | Total refined lubricating oil | .. | .. | 3·91 |
| 1·4 | Paraffin wax, purified | 3 | .. | 0·33 |
| 15·5 | Higher phenols and cresols, boiling 200° to 300° C. Highly disinfectant R. W. = 15 | 32·5 | = 3·13 | .. |
| 21·5 | Phenols above 300° C., R.W. = 3 | 45·2 | = 4·35 | .. |
| | Total acid oils | .. | .. | 7·48 |
| 13·1 | Pitch coke | 27·5 | .. | .. |
| 5·2 | Distillation losses | .. | .. | .. |
| 10·6 | Refining losses by using 10 p.ct. sulphuric acid, concentrated | .. | .. | .. |
| 100 | Saleable refined oils recovered | .. | .. | 14·835 |

The unsaturated compounds removed by the concentrated sulphuric acid may be recovered, and could, therefore, be added to the above.

## ALKALI WORKS CHIEF INSPECTORS' REPORT.

There has just been published by His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C., and Branches, at the price of 1s. net, the sixty-second annual report on alkali, &c., works, which has been presented to the Minister of Health and to the Scottish Board of Health by the Chief Inspectors.

Dealing with the work done during the year 1925 under the Alkali, &c., Works Regulation Act, 1906, Dr. T. Lewis Bailey (the Chief Inspector for England and Wales) says the total number of works registered was 1177, which was a reduction of 33 on the previous year. The 1928 separate processes inspected showed a falling-off of 62. The number of visits of inspection by the district inspectors to registered works during the year was 3956. As to the results, Dr. Bailey remarks: "In spite of poor conditions of trade generally, it is gratifying to see the foresight displayed throughout the chemical industry, not only in the working of plant under the best possible conditions, having regard to the circumstances, but also in the vision of future possible developments in new directions. It is a healthy sign when manufacturers are no longer content to work their plants in routine fashion, but turn their attention to such problems as the possibility of the more efficient and more economical operation of them, and, furthermore, whether the type of plant that has been employed in the past may not with advantage be modified, or even superseded with a new type."

### Sulphuric Acid Works.

During the past year work has been taken in hand, first, with a desire to ascertain what reactions take place when the exit gases from the Gay Lussac tower are scrubbed with a limited amount of water, and, secondly, by reason of the considerable variations in the percentage of nitre actually used in different acid plants. The details of the work are given in an appendix to the report.

### Wet Purification of Coal Gas.

During the year under review, the wet purification of coal gas has reached trial on a working scale in this country, though not in its final form. The process in its latest style depends on the absorption of $H_2S$ and HCN from crude coal gas by means of an alkaline solution, with recovery of sulphur, as such, in a subsidiary operation. The difficulty hitherto (and the objection to the introduction of the process in this country) has been the need of a method of economically recovering the sulphur; and it seems likely, remarks Dr. Bailey, that this difficulty has now been overcome. To remove the $H_2S$ from the wash solution, and to pass it into the air, or to burn it, would have been easy enough; but such pollution of the atmosphere as would result renders disposal methods of this kind out of the question.

### Sulphate of Ammonia and Gas Liquor Works.

The production of a high-strength neutral sulphate has now become quite general. The methods of dealing with the foul gases given off in manufacture have undergone no change; and instances of inefficient supervision have been few. It has, however, been necessary at several works to press for reconstruction of purifier floors. There is, the report points out, always possibility of the cracking of such floors after prolonged use; and this fact should be borne in mind, for sulphuretted hydrogen, passing through cracks in the purifier floors, may travel considerable distances below ground before making itself manifest.

The ammonia plant effluent disposal difficulty continues to obtrude itself in fresh directions; and it is more and more apparent that the problem must be tackled from the coal gas manufacturing side—as was pointed out in the last report. After saying this, Dr. Bailey adds that it is gratifying to see that more than one gas manager has of late been working on the lines suggested, and with promising results. From the laboratory side, there is little to add this year.

### Tar Works.

Instances are still found of pitch coolers needing attention; but on the whole recent years have witnessed a great improvement in this respect, due to the activities of the district inspectors. In the year under review, there were few complaints against tar works; and such as were received related to minor incidents of short duration. The adoption of a manhole cover, with pitch-cock attached, at the bottom of tar stills, as referred to in the last report (see "Journal" for July 1, 1925, p. 47), is extending.

*Ammonia Products Manufactured in 1925 (expressed as Sulphate, 25¾ p.ct. $NH_3$)—Tons.*

| From Liquor Produced in— | 1925. | 1924. | 1923. |
|---|---|---|---|
| Gas-works | 148,945 | 151,161 | 142,980 |
| Other works (including coke-ovens, iron-works, producer gas, synthetic, &c.) | 201,667 | 211,019 | 185,016 |
| Total. | 350,612 | 362,180 | 327,996 |

Note.—Of the total quantity of ammonia products, the equivalent of 31,581 tons was manufactured as concentrated ammoniacal liquor; the balance of 319,031 tons consisted of other ammonia products (sulphate, chloride, nitrate, &c.).

*Tar Products Manufactured in 1925.*

| — | Gas and Coke Oven Works. | Other Works. |
|---|---|---|
| | Tons. | Tons. |
| Tar distilled | 1,490,521 | 10,145 |
| Pitch produced | 461,241 | 4,312 |

### Report for Scotland.

The report of Mr. J. W. Young states that the number of works registered in Scotland was 150; and there were 482 visits to these works.

*Ammonia Products, Tar Distilled, and Pitch Produced.*

| — | Salts of Ammonia. | Tar Distilled. | Pitch Produced. |
|---|---|---|---|
| | Tons. | Tons. | Tons. |
| From gas-works | 22,134 | 144,993 | 34,468 |
| ,, iron-works | 2,518 | 24,359 | 12,866 |
| ,, coke ovens | 5,835 | 12,940 | 4,073 |
| ,, producer gas | 4,019 | 6,535 | 2,858 |
| ,, shale-works | 44,400 | — | — |
| Total, 1925 | 78,905 | 188,827 | 54,265 |
| In 1924 | 91,228 | 218,725 | 77,885 |

### Sulphate and Muriate of Ammonia and Gas Liquor Works.

The yield of ammonia from gas-works was slightly greater, but from all other sources less. Quality continues to improve. It was necessary at one works to ask for re-organization throughout of the sulphate of ammonia plant, which for a long time had been defective in many points. Immediate attention was given to Mr. Young's request, and a most satisfactory plant is now in use. At two other works there has been similar re-organization spontaneously.

It is, says the report, noted that the centrifugal driers, for extracting mother liquor, are often too small, and also how quickly their metallic lining, usually of copper, perishes. In one case this lining is of jute canvas. Its cost is small, it is flexible, and it is easily replaced after a short existence. Iron, steel, and aluminium have been tried in place of copper, and have endured somewhat better than was expected. Possibly experiments with alloys might indicate the choice of a metal, comparatively inert to corrosion by acid and ammonia, and hard enough to withstand the shocks of manufacture, and attrition by the crystals.

Wooden hurdles, such as are inserted in oxide purifiers at gas-works to promote porosity, are used to advantage by the Hawick Gas Company in the storage and drying of their sulphate.

### Tar Works.

Tar stills and dehydrators increase in number and in variety, but there is less material to supply to them. The cost of

transport has had important influence. Efficiency has been much improved, even in the smaller and simpler stills, although there yet remain some which deliver "prepared tar" incompletely freed from naphtha and water. The fumes from plants in which solid and other materials are incorporated with hot tar in order to form road cement and binding liquids have caused some annoyance. The difficulty in the complete condensation of these fumes is increased by the presence of even small amounts of water in the solids. Previous drying is easy; and waste heat is available free of cost.

## HOLYWOOD.

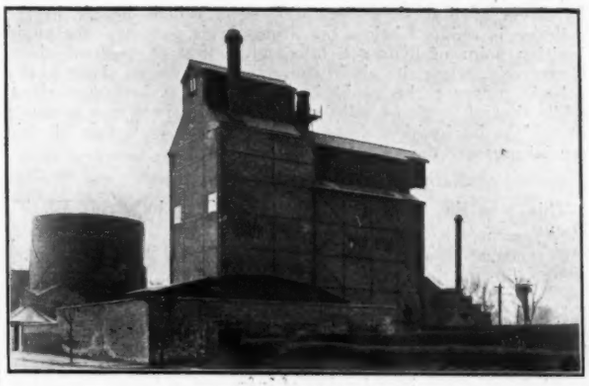
The Gas-Works at Holywood were established in the year 1859, and the area supplied extends from near the outskirts of Belfast to as far as Craigavad, in the Bangor direction. For the available consumer population of 5000, the mileage of mains must seem abnormally high to those whose concern is with the supply of large congested industrial areas. There is absolutely no industry in the area of the Holywood gas supply.

The first vertical installation at Holywood consists of a bench of six Glover-West retorts arranged in two settings of three retorts. Each retort is also an individual unit. One producer is provided for each setting. This plant was erected in 1916, and gas-making was commenced in February, 1917.

The output of the undertaking has steadily increased since the end of the war. The annual consumption in 1920 was 36 million c.ft.; by 1925 it had risen to 53 millions. This steady growth has made necessary an extension of the plant, and a new bench was commenced in June of last year. The new extension consists of a bench of four "New Model" 33-in. Glover-West verticals. The retorts are arranged in two units of two, the heating arrangement being of standard design. They were put into operation on March 26.

The most striking feature of the new retorts is their extreme flexibility in working and control. One of the objections often met in the consideration of verticals for small gas-works is that the size of the units militates against the flexibility of working which is so essential a requirement. For the conditions at Holywood it was found only necessary to work two of the new retorts, owing to the fact that sufficient flexibility was obtained in normal working, so that the yield from each retort could be controlled from a maximum of 80,000 c.ft. of gas per day down to about 35,000 c.ft., at the same time maintaining a constant average calorific value of 450 B.Th.U., which is the grade of gas needed for the locality.

The three controls required to obtain the flexibility are: Speed of extraction, regulation of steam valve to retort, and waste-gas damper. These three elements of flexibility only occupy a minute or two for adjustment. The elimination of the multifarious operations, of the dust, dirt, and arduous labour involved in hand-charging under the old system of



carbonizing so prevalent in small gas-works, the opportunity of obtaining results equal to the most efficient of the largest undertakings, are surely ideals which will be cherished by all responsible for the management of the medium and smaller sized works.

## EXPLOSIVE REACTIONS IN GASEOUS MEDIA.

### Discussion before the Faraday Society.

A general discussion on this subject was held on Monday, June 14, at the Institution of Mechanical Engineers. In spite of restricted train services due to the miners' strike, the meeting was very well attended, among those present being Profs. Arthur Smithells and E. C. Williams (whose work in connection with benzole is well known to the gas industry) and Dr. R. Lessing. The programme was a lengthy one, and was divided into two sessions; one in the afternoon, the other in the evening. At the former, when the subject of explosive reactions was considered generally, Prof. H. B. DIXON took the chair, and at the latter, when the question was dealt with in relation to internal combustion engines, Sir DUGALD CLERK presided.

#### PART I.

#### GENERAL SURVEY.

The first paper to be submitted was by Dr. W. E. GARNER, in which the author gave a general survey of the question. The study of gaseous explosions, he said, commenced with the discovery by Volta, in 1777, that a mixture of hydrogen and air could be exploded by an electric spark. This experiment in the hands of Cavendish led him to make his statement with regard to the composition of water; but it needed the incentive of an urgent industrial problem—that of the occurrence of explosions in coal mines—before a comprehensive investigation of gaseous explosions was undertaken. This, carried out by Davy, resulted in the perfection of the safety lamp. The discovery of the detonation wave in 1881, independently by Le Chatelier and Berthelot, introduced an epoch of quantitative measurement; their methods for the accurate determination of the velocities of, and the pressures set up in, the explosion wave forming the basis of the subsequent experimental work by Dixon and others. The classical contributions of Berthelot, Le Chatelier, and Dixon, remarked Dr. Garner, constitute the most valuable chapter in the history of the subject. Since 1881 to 1903, which was a period of rapid progress, much work has been carried out which has contributed accurate data on specific heat of gases at high temperatures, limits of inflammability, ignition temperatures, speeds of movements of flame, &c., which have accelerated the development of the gas engine. The author then went on to consider the magnitude of the problem, and its complexities. He outlined the outstanding investigations into temperatures of combustion, specific heats of gases, and ignition temperatures, defining the ignition point as that temperature to which a volume of gas, when completely insulated from its surroundings, must be heated so that it gives rise to flame in unit time. Remarks on the propagation of flame, and its uniform movement, and on the limits of inflammability, were followed by consideration of the question of activation in front of a flame by emission of radiation and of ions. The chemical processes in front of a flame or explosion wave may be accelerated either by a rise in temperature or by activation of individual molecules by absorption of radiation or by collision with electrons or ions. A rise in temperature may be effected by collision—or, in other words, thermal conductivity—adiabatic compression, or by the absorption of infra red radiation. The author concluded by saying that, as would be expected from the dominant rôle of chemical kinetics in gaseous explosions, anomalous behaviour can generally be traced to some catalytic effect on the velocity of chemical change. A variation in the speed of the explosive reactions due to any cause will modify not only the ignition temperatures, the speeds of uniform movement, and the velocity of detonation, but also all the other properties of gaseous explosions. This is certainly so for the positive catalytic effect of water on the combustion of carbon monoxide and oxygen, where the phenomena of ignition and those of detonation are equally affected. Negative and positive catalytic processes play equally important parts in explosive phenomena.

#### IGNITION POINT OF GASES.

By the aid of lantern slides Prof. DIXON then outlined a paper by himself and J. HARWOOD and W. F. HIGGINS on the ignition point of gases. He described briefly the two methods—adiabatic compression and the concentric tube—by which he and his co-workers have obtained values for the ignition point which are most closely in agreement with the definition of this property given by Dr. Garner. Explanation was given of how the method of adiabatic compression suggested by Nernst and carried out by Falk had been modified in order to give the ignition point of slowly combining mixtures such as hydrogen with a large excess of oxygen or with air. This modification consisted of arresting the piston in the adiabatic machine when the ignition-compression was reached; and the values Dixon obtained in this way were considerably lower than those put

forward by Falk. A source of error affecting slow-firing mixtures, remarked Prof. Dixon, was pointed out by Tizard and Pye. If the piston is merely arrested and not held in place when the ignition-compression is reached, the gas during the self-heating pre-flame period may do work against the piston, and so be cooled. This error has been corrected by utilizing the toggle-joint of Ricardo; and the new machine embodying this device gave ignition points slightly lower than those of the old machine in which the piston was clamped. A further improvement in the new apparatus was the introduction of an "air-buffer" chamber, which reduced the time of the piston stroke by one-third. Experiments made on methane with air showed that the most inflammable mixture was that containing about 7⅓ p.ct. of methane. The ignition point for this mixture calculated from the compression was 428° C., the pressure at this point being 28 atmospheres. Speaking on the experiments carried out in the concentric tube, Prof. Dixon observed that the effect of variations of pressure on hydrogen and on methane in air is at first sight very different. When the air in the cylinder is reduced below the atmospheric pressure, the rapid ignition point of hydrogen falls, while that of methane rises. Conversely, when the air in the cylinder is raised above atmospheric pressure the rapid ignition point of hydrogen rises, while that of methane falls. For each gas there is a pressure at which the ignition point is highest; on each side of this crucial pressure the values fall.

### Radiation in Gaseous Explosions.

This was the title of a paper submitted by Prof. W. T. David. In the first part the author gave a short account of experiments made upon the emission of radiation from exploded gaseous mixtures contained in a closed vessel which throw light upon the nature and origin of the emitted radiation, and in the second part he dealt with recent work demonstrating the effect of introducing infra red radiation into inflammable gaseous mixtures containing nitrogen upon their rate of combustion. He remarked that the experiments show that combustion is speeded up by the introduction of infra red radiation, provided that the radiation is of the kind which is absorbed by the combustible gas, that nitrogen is present as a constituent of the inflammable mixture, and that the mixture composition is such as to be favourable to the formation of oxides of nitrogen during combustion. At first sight, said Prof. David, it may appear that the effect of radiation is to inhibit the formation of oxides of nitrogen and thus accelerate combustion by suppressing the endothermic action which goes on during their formation. But if this were the case, the same type of radiation would be expected to speed up combustion whatever the nature of the combustible gas, whereas experiment shows that different kinds of radiation are necessary for different gases. An explanation which would appear to cover the experimental observations is that during combustion in a closed vessel there is some kind of temporary association or interplay between the molecules of the oxides of nitrogen and those of the combustible gas which tends to retard combustion, and that such association or interplay is, to some extent, inhibited when the molecules of the combustible gas acquire vibratory energy by the absorption of infra red radiation, with a consequent increase in the rate of combustion.

### Ionization in Gas Explosions.

The next paper was by Dr. Garner and S. W. Saunders, who dealt with the question of ionization in gas explosions. They draw the following tentative conclusions from the somewhat scanty data which exist. The ionization occurring in gaseous explosions is mainly thermal in character, though from the measurements on ionization at room temperature it is not improbable that a small fraction is due to chemical change. Ionization plays no part in the ignition of gases. The hypothesis that the ionization of the gas in front of the explosion is the cause of the propagation of the detonation wave appears to have been disproved, though Malinowski's investigations render this conclusion somewhat uncertain. The action of anti-knocks and knock inducers in the petrol engine cannot be satisfactorily explained by the theory of Wendt and Grimm.

In another paper on the same subject, S. C. Lind came to the same conclusion as the authors of the previous paper—that, while there may have been some reasons for supposing gaseous ionization to be the cause of the rapid propagation of gaseous explosions or of flame detonation, no conclusive evidence has ever been found for that theory; the present trend of support is towards purely thermal propagation.

### Uniform Movement of Flame.

The work of Prof. R. V. Wheeler and Dr. W. Payman, who contributed a "Note on the Uniform Movement during the Propagation of Flame," is well known to readers of the "Journal." In the absence of Prof. Wheeler, Dr. Payman outlined the paper, saying that when an inflammable gas mixture contained in a horizontal tube closed at one end and open at the other is ignited at the open end, the flame produced travels for a certain distance at a uniform speed, after which it begins to vibrate backwards and forwards. The initial spread of flame is termed the "uniform movement." He continued that the effect of change of composition on the speed of uniform movement is important from chemical considerations. In a series of air mixtures with a given inflammable gas, it is always found that, instead of the mixture with the greatest calorific value (that is, one containing just sufficient oxygen for the complete combustion of the inflammable gas) having the greatest speed of flame, the greatest speed is attained in a mixture containing excess of the inflammable gas. This is most noticeable with mixtures of hydrogen and air—a fact which led Mallard and Le Chatelier to conclude that the greater thermal conductivity of hydrogen compared with that of air was responsible. Dr. Payman remarked that Prof. Wheeler and himself had shown, however, that the same is true with inflammable gases the thermal conductivity of which is less than that of air, and had explained the effect as due to mass action, assuming the speed of flame to be dependent upon the rate of chemical reaction in the burning mixture. The displacement of the maximum speed mixture when air is used to burn the gas is dependent upon the fact that the incombustible gas, nitrogen, is always present in an amount constant in proportion to one of the reacting gases, the oxygen. When the speeds are determined with a series of mixtures with oxygen *plus* a hydrogen-nitrogen mixture of constant proportion, instead of with the usual mixtures of hydrogen *plus* an oxygen-nitrogen mixture of constant proportion (*e.g.*, air), the displacement is towards an excess of oxygen. With mixtures of hydrogen and oxygen only, the greatest speed is obtained with the mixture containing the two gases in combining proportions. There is no displacement.

When attempting to make practical use of the results of the uniform movement of flame, continued Dr. Payman, one is faced with the difficulty that few industrial inflammable gases consist of one simple gas. Not only are they usually of complex composition (*e.g.*, coal gas), but the relative amounts of the individual gases contained in them are subject to considerable variations according to the mode of manufacture. To determine the speeds of uniform movement of flame with a range of air mixtures of each industrial gas would be very laborious. Fortunately, a simple additive relationship has been found by means of which the speed of the uniform movement of flame can be calculated for a series of mixtures of air with any industrial gas provided that the speeds with the simple inflammable constituent gases are known. This has been termed "the law of speeds," which states that if a complex mixture is made by blending a number of mixtures of air with simple combustible gases all of which have the same speed of uniform movement of flame, then this complex mixture will also have the same speed of flame provided that all mixtures are of the same type—all containing excess of oxygen or all containing excess of inflammable gas. A slight extension of this enables one to calculate the speed of the uniform movement of flame of any industrial inflammable gas in any mixture with air.

Dr. Payman remarked that an important deduction from the law of speeds is that during the propagation of flame in a complex mixture of combustible gas and air, the combustion can be regarded as involving the simultaneous but independent burning of a number of simple mixtures of the individual gases with air, in which the proportions of inflammable gas and air are such that each mixture, if burning alone, would propagate flame with the same speed as does the complex mixture. Two mixtures, one of methane and the other of hydrogen, with air, having the same speed of flame and containing insufficient oxygen for complete combustion, contain widely different proportions of inflammable gas and oxygen. During the propagation of flame in a complex mixture of methane, hydrogen, and air made by blending these two mixtures, the combustion of the methane-air mixture is as though it were alone, or as though the hydrogen-air mixture that dilutes it were a further quantity of the methane-air mixture.

Though the speed of uniform movement of flame in an inflammable gas mixture is a physical constant for that mixture in any one tube at a given temperature and pressure, the uniform movement only occurs under specified experimental conditions. Concluding his remarks, Dr. Payman emphasized the importance of correlating pressure effects with rates of spread of flame.

Mr. R. P. Fraser, who is one of Prof. W. A. Bone's collaborators, said that the law of speeds did not hold good for a $C_2H_2 + 2H_2 + O_2$ mixture. When such a mixture was burned, the oxygen combined with the carbon only, with the result that the speed of uniform movement of flame was lower than that calculated from a knowledge of the speeds of hydrogen-oxygen and acetylene-oxygen mixtures. Moreover, he observed, it had been found that ignition of a dried $2CO + O_2$ mixture in a closed cylinder produced a flame having no uniform velocity, but a uniform acceleration. In reply to this, Dr. Payman said that the conditions of the experiments referred to by Mr. Fraser were different from those upon which his (the speaker's) conclusions were based.

### Explosions at High Pressures.

At this stage Prof. Bone was to have given a résumé of the researches which have been carried out during recent years in the Department of Chemical Technology of the Imperial College of Science and Technology upon the explosion of hydrogen-air and carbon monoxide-air mixtures at initial pressures up to 175 atmospheres. Though he was present at the commencement of the meeting, he had to depart before this was possible;

and it was left to Mr. FRASER to refer briefly to the work. He mentioned the new experiments upon the combustion of well-dried carbon monoxide-oxygen mixtures. An account of these was given in the "JOURNAL" for April 28, p. 217. See also Prof. Bone's lecture on p. 721 of this issue.

Dr. COLIN CAMPBELL briefly discussed the work of Prof. DIXON and himself on the explosion wave in cyanogen mixtures, following which a few remarks by Sir DUGALD CLERK brought the first part of the programme to a close. He suggested that a study of the effects of turbulence would probably throw light on the question of nitrogen activation in gaseous explosions.

## PART II.

### GENERAL SURVEY.

Sir DUGALD CLERK opened the second part of the programme by an introductory survey of the question of explosive reactions considered in reference to internal combustion engines. Having mentioned the need for further work in connection with the variation of specific heat between 0° and 2000° C. of the gases which form the working fluid of the internal combustion engine, and the necessity for obtaining more accurate values as to dissociation and continued combustion and heat loss during initial combustion and expansion and by convection and radiation, he said that, while considerable progress had been made by the late Prof. Bertram Hopkinson, Prof. Dixon, and other members of the British Association Gaseous Explosions Committee, there was still ample opportunity for the younger men; and he studied with singular pleasure the important papers on engine cylinder phenomena by Ricardo, Tizard, Pye, and Gibson, and on explosions in closed vessels by Petavel, Bone, Wheeler, and Fenning. The hot air engine, he continued, was the forerunner of the internal combustion engine, and its theory was developed by Rankine, Joule, and Thomson before 1850. Air was considered to have constant specific heat at all working temperatures; and on this assumption the Joule air engine was shown to have an ideal efficiency where U = indicated work, $H_1$ = the total heat received, and $r$ = the ratio of compression and expansion of $\frac{U}{H_1} = 1 - \left(\frac{1}{r}\right)^{0.408}$. This appeared to be the first instance of the recognition of a cycle of operations of constant efficiency—that is, constant for all maximum temperatures. This expression had been shown to apply to the three existing cycles of internal combustion engines (assuming air as the working fluid)—the constant pressure, the constant volume, and the constant temperature, or Carnot, cycles. In all three the ideal efficiency was given by the well-known expression $E = \left(\frac{1}{r}\right)^{\gamma-1}$. The air standard for internal combustion engines was adopted by the Council of the Institution of Civil Engineers in 1905. It was well understood, however, that the actual working fluid differed materially from air; and the author said that he had pointed out at the time that the actual fluid without heat loss could only give as a maximum approximately 0·7 of the air standard value in good modern engines. Sir Dugald concluded his remarks by referring to the work of Hopkinson and David on radiation in 1908-9 and the discovery of the effect of turbulence by Hopkinson and himself in 1911-12.

### COMBUSTION IN GAS ENGINES.

Prof. DAVID then submitted a paper on this subject, in the first part of which was discussed the extent to which incomplete combustion of the charge is responsible for limiting the pressures developed in gas engines. There appears to be little doubt, he said, that incomplete combustion ranks equally with increasing specific heat as a primary cause limiting the pressures developed. After-burning does not affect the thermal efficiency of a gas engine to any serious extent provided that the ignition timing is arranged to give a reasonably vertical explosion line in the indicator diagram, for the bulk of the after-burning takes place in the early stages of the expansion stroke; indeed, from the point of view of mechanical design, it is an advantage in that it tends to reduce the ratio of the maximum pressure to the mean effective pressure.

The second part of the paper, of which the following is a much condensed summary, dealt with the factors influencing the rate of combustion. The nature of the fuel used, the mixture strength, and the composition of the inert gases exercise a great influence upon the rate of combustion. The greater the proportion of hydrogen in the fuel, the greater the proportion of fuel to air in the charge; and the less the amount of cooled products of combustion, the faster will be the burning. The greater the degree of turbulence or eddying of the gaseous charge, the more rapidly will inflammation spread. The reason why turbulence has such a great influence upon the rate of burning would appear to be that, owing to the actual motion of the gaseous charge, parts of the portion first inflamed are carried to various quarters of the charge, and in effect a large number of ignition centres are set up. Owing to the compression of the charge before firing, the density of the charge during explosion may be from four to six times atmospheric density. Closed vessel experiments with fuels of the type usually employed in gas engines show that sometimes the time of explosion increases slightly as the density is increased, and sometimes decreases slightly with increasing density. Crowe and Newey pointed out that this was to be explained in terms of the relative proportions of hydrogen and carbon monoxide in the fuel. The time of explosion of hydrogen-air mixtures decreases as the density increases, whereas that of carbon monoxide-air mixture increases with the density. The time of explosion of gas-air mixtures rich in hydrogen will thus decrease as the density increases, whereas the contrary is the case when the gaseous fuel is rich in carbon monoxide. In this connection some recent experiments by Dr. A. F. Burstall are of interest. He has shown that as the compression ratio is increased from 4 to 7 in a particular engine using as fuel a coal gas rich in hydrogen, the time of explosion is decreased by about 15 p.ct. Here, however, an increase in the compression ratio also involves a rather higher temperature of the gaseous charge before ignition and a decrease in the proportion of the inert products of combustion. Both these factors tend to decrease the time of explosion, and consequently the 15 p.ct. decrease in the latter is not wholly due to increased density. Burstall has since run his engine using CO as a fuel, and finds only a small variation in the time of explosion with compression ratio. Thus the tendency of CO mixtures (containing $N_2$) to slower burning with increasing density, as shown by closed vessel experiments, would appear to be balanced by the tendency to more rapid burning due to a higher gas temperature before ignition and a decrease in the proportion of the inert products of combustion.

The temperature of a gas engine charge (which may be as high as 350° C. at the moment of ignition) has some influence upon the rate of explosion. Fenning's recent experiments, in which he heated gaseous mixtures of the same density contained in a closed vessel and then determined their rate of explosion after igniting by means of an electric spark, seem to show that the influence of temperature is not very great. It has been shown that in mixtures of carbon monoxide and air, methane and air, ethane and air, and coal gas and air the rate of explosion is increased by introducing into the gaseous mixture before explosion infra red radiation of the type which can be absorbed by the combustible gas. Thus the time of explosion of an 8 p.ct. mixture of $CH_4$ and air was reduced by about 15 p.ct. by introducing into the gaseous mixture before explosion a small quantity of radiation, of which the amount absorbed amounted only to a small fraction of 1 p.ct. of the heat of combustion of the methane contained in the vessel.

To secure rapid combustion, it is necessary to arrange that the flame has as small a distance as possible to travel from the igniting point to the walls of the combustion chamber. The latter should therefore be compact, and the spark placed centrally. The ideal would be a spherical combustion chamber with the spark placed in the centre. The timing of ignition has a great influence upon the shape of the explosion line in the indicator diagram, and therefore upon the efficiency of the engine. In practice the time of ignition is generally arranged so that the maximum pressure is reached when the piston has travelled forward a short distance, representing (say) 10° or so of crank angle after inner dead centre. This makes for smooth running and tends to reduce heat losses. The timing of the ignition to effect this varies greatly with the nature of the fuel employed, the mixture strength, and the degree of turbulence. Dr. Burstall has shown that if the ignition timing be advanced much beyond that customary, it is possible to run gas-engines efficiently at far higher speeds than have hitherto been thought possible of attainment even when using mixtures of only moderate strength.

Two more papers—one by H. T. TIZARD, on "Explosions in Petrol Engines;" the other by Flight Lieut. C. J. SIMS and Dr. E. W. J. MARDLES, on "The Effect of Metallic Sols in Delaying Detonation in Internal Combustion Engines"—completed the programme.

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**Use of Gas in Sheffield Industries.**—The current issue (No. 147) of "A Thousand-and-One Uses for Gas" deals with many recent developments in the heat-treatment of metal in Sheffield, and should be read by everyone interested in the application of gas to the production of metal goods. The publication is illustrated with views taken in some of the finest manufactories in Sheffield.

**Royal Sanitary Institute Jubilee.**—The Royal Sanitary Institute, which has been working for fifty years in the cause of public health, is celebrating its jubilee by holding an Imperial Congress in London from July 5 to 10, under the Presidency of the Minister of Health, the Right Hon. Neville Chamberlain. More than a thousand delegates have been appointed by Government Departments to attend.

**Turpentine, White Spirit, and Linseed Oil.**—The British Engineering Standards Association have just published British Standard Specifications, Nos. 243, 244, and 245 (1926), dealing respectively with "White Spirit, Type 1, for Paints;" "Turpentine, Type 1, for Paints;" and "Raw Linseed Oil for Paints." They contain clauses regulating the composition, and information regarding standard reception tests. Copies of the new specifications can be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W. 1; price 1s. 2d. post free.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by Correspondents.]*

## Posen Tankless Holder Explosion.

Sir,—It is with much interest we have read your article on the gasholder accident in Poland. This accident was fully reported at the time in the German Press, and also subsequently discussed at a conference when 34 of the leading gas engineers in Germany were present. We suggest that your comments hardly make this point clear—more especially as the unanimous decision of the engineers in conference was that the accident in itself was due to no fault in either the design or the workmanship of the holder.

Reading your article, it appears to us that the Posen Gas Engineer must have supplied you with very incomplete information. The sealing liquid used in the "M.A.N." gasholder has to be a gas-works tar to a very definite specification, designed to meet local conditions, and should in any case contain no water whatever. Furthermore, may we point out that several weeks before the accident happened it was observed that the disc had tilted to an extent of 8 in., and that the top was covered with tar and water. From investigations made after the accident, it appears that the foreman of the gas-works had adopted the extraordinary procedure of shifting ballast weights from the dropped side of the disc to the raised side—this without authority of his superiors, and quite contrary to the rules laid down by the "M.A.N." for the proper working of their gasholders. Upon investigation, it was proved that the disc had been loaded unequally to the extent of 75 p.ct. That this accident happened with the Posen holder cannot be a matter of surprise, inasmuch as the timely instructions given to remove the water and tar and to replace the ballast weights into their original position were unheeded.

May we, in conclusion, add that we shall be glad to show you, or any gas engineer seriously interested in this new development in gas-holder practice, a copy of the report on the conference held by the 34 German gas engineers.

John Le Boutillier, Ltd.,
John Le Boutillier, Managing Director.

57, *Bishopsgate,*
*London, E.C.* 2,
*June* 26, 1926.

[We should be pleased to receive a copy of the report of the conference held by the 34 German gas engineers.—Ed. "G.J."]

## Dimensions of Iron or Steel Tubes.

Sir,—The question of the difference between the actual and the nominal internal diameters of steel tubes was raised in correspondence arising out of the article on "Gas Supply in Bulk by Long Distance Transmission," which appeared in your issue of Feb. 10. Mr. F. S. Cripps pointed out that in Table 1 of that article, if by the "diameter of pipe in inches" was meant the actual bore of the main (as might naturally be assumed), then the factor A as tabulated did not agree with the value as calculated from the formula from which it was supposed to be derived. The reply of the author was that in Table 1 the column "diameter of pipe in inches" did not refer to the actual bore of the main on which the factor A was based; and he gave a table showing the actual bore in each case, there being great difference in the larger sizes.

Mr. Cripps thereupon wrote to us asking what was the relation between the "nominal" and "actual" diameters. The information in our reply was considered by him of interest to gas engineers and suitable for publication in your pages.

Our notes ran:

Actual Internal Diameters of Iron or Steel Tubes.

The relation of the bore of an iron or steel tube to its outside diameter depends partly on the size of the tube.

Standard gas, water, and steam tubes with screwed and socketed joints up to 6 in. diameter are universally described by the "nominal" bore, but supplied to fixed outside diameters, and in consequence the "actual" bore varies with the thickness of the tube. For example, a 2-in. tube, the outside diameter of which is $2\frac{3}{8}$ in., would have a varying actual bore depending on the quality, as follows:

| — — | Gas. | Water. | Steam. |
|---|---|---|---|
| Thickness—I.W.G. . . . . | 8 | 7 | 6 |
| ,, Inches . . . . . | 0·160 | 0·176 | 0·192 |
| Actual bore inches . . . . . | 2·055 | 2·023 | 1·991 |

A fixed outside diameter is a necessity for screwed and socketed tubes, as they have to connect to a great variety of standard fittings. Any deviation from fixed external dimensions would cause needless expense on screwing plant and on the actual screwing of the tubes and fittings. A further advantage, reducing not only the cost of the plant but the loss consequent upon stoppages to change rolls, is effected in the manufacture of lapwelded tubes up to $12\frac{1}{4}$ in. outside diameter by only one set of rolls being required for each nominal bore.

Tubes having spigot and socket joints for lead and yarn, or similar joints, for the conveyance of gas or water, other than screwed tubes, are also made by us. In sizes up to 12 in. diameter these also are made to fixed external diameters, so as to economize in the number of tools required for forming the joints. In sizes over 12 in. diameter, however, the system changes, and we work to the actual bore of the tube, instead of external diameter.

For tubes manufactured abroad it is not possible to give definite rules, but generally the position as regards screwed and socketed tubes is the same, the outside diameter remaining invariable and the bore varying with the thickness.

While for this country such tubes would probably be supplied to British Standard screwing sizes—that is, of outside diameters similar to those we have quoted—the thickness may differ from those to which British manufacturers work, but the possibility of misunderstandings is, of course, increased when dealing with foreign manufacturers.

In American practice tubes over 12 in. bore are described by their outside diameter—that is, a 16-in. tube is understood to be 16 in. outside diameter. The tubes 16 in. nominal diameter and upwards in Mr. Nielsen's table appear to be so described.

Where the knowledge of the actual bore of a main is important, engineers should request tenderers to specify the actual internal diameters of the tubes which they offer.

Stewarts and Lloyds Limited.
R. A. Morrison, Secretary.

41, *Oswald Street, Glasgow.*
*June* 23, 1926.

## Controllers for Hyde Park Lamps.

Sir,—Referring to the note appearing on p. 234 in your issue of April 28 last, regarding the above, we beg to point out that practically the whole of the gas lamps in Hyde Park are fitted with our "London" automatic clock controller.

The Gas Meter Company, Ltd.

238, *Kingsland Road,*
*London, E.* 2,
*June* 25, 1926.

## Complete Gasification.

Sir,—The very interesting report of the hearing of the Helps *v.* Oldham Corporation action in your recent issues again raises the vital issue of complete gasification forming the general backbone for gas making operations. According to no less an authority than Sir Dugald Clerk, anybody coming forward in 1918—and the position still holds good to-day, and will continue—with an apparatus which could be usefully employed, and which would give the greatest availability of heat units with 350 or 400 B.Th.U. gas, would be rendering, undoubtedly, a considerable public service. This is due to the higher efficiency with 400 B.Th.U. gas than with 500 gas—more heat units for a given sum being made use of at the consumer's appliance.

Granted this general rule, and the availability of a complete gasification system capable of handling coals of any character, which will economically yield a cheaper gas than any partial gas making system on carbonizing lines, what is there to prevent the bulk at least of the gas requirements of undertakings being carried out on these lines and of a calorific value around 400 B.Th.U.? Surely, the logical outcome lies solely along such lines. Further, if hand in hand therewith is developed the most economic system of smokeless solid fuel production, also yielding a rich gas for enrichment purposes, the gas industry will thereby be able to give tip-top competitive satisfaction of the following fuel and energy requirements: (*a*) Gas for domestic heating, cooking, and lighting, and industrial purposes; furnaces, &c.; (*b*) a smokeless semi-coke, far superior to gas coke, equal to domestic requirements now satisfied by raw coal; and (*c*) cheap power gas for electrical generation, &c., of different calorific values from that of the main supply above—see (*a*)—at a different price, together with (*d*) an optimum yield of bye-products and an absolute resilience and elasticity to all possible competitive forces, giving a marked supremacy in its favour to hold its own and prosper in rivalry with other fuel interests.

Wm. Everard Davies.

5, *Tynybedw Terrace,*
*Treorchy, Glam.,*
*June* 26, 1926.

In the "Sheffield Independent" Housing Scheme Supplement for June 25, there is an article, entitled "The Handmaid of the Housewife," in which attention is drawn to the benefits of a gas supply. Mention is made of the fact that the Sheffield Gas Company cater for no fewer than 125,304 consumers. The amount of gas sold in 1925 was 4876 million c.ft., and its price was 2s. 11d. per 1000 c.ft. for domestic purposes, down to as low as 1s. 8d. for large consumers.

On June 24 the Oswaldtwistle District Council decided to purchase 200 tons of foreign coal for their gas undertaking. Councillor Scholes, Chairman of the Gas Committee, said they had sufficient coal in the gas-works to carry on until the end of July or the beginning of August. The position in the mining industry, however, did not seem favourable; and they had thought it wise to order the coal, and review the position in another fortnight.

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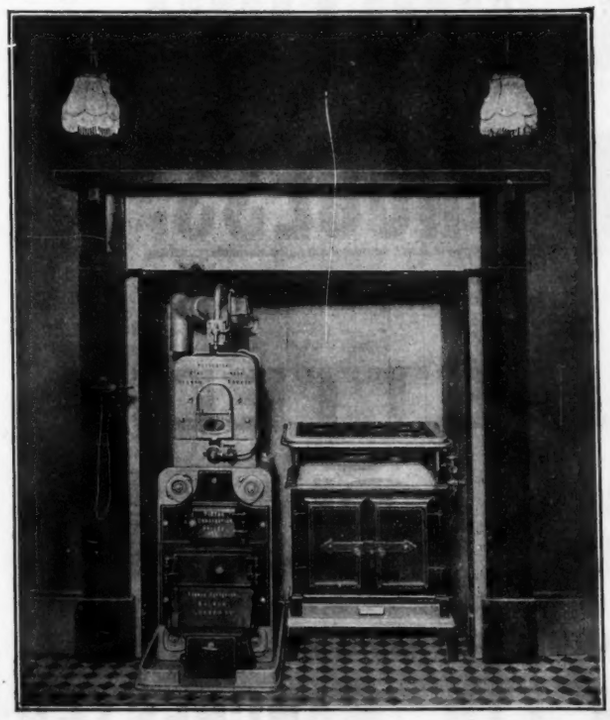

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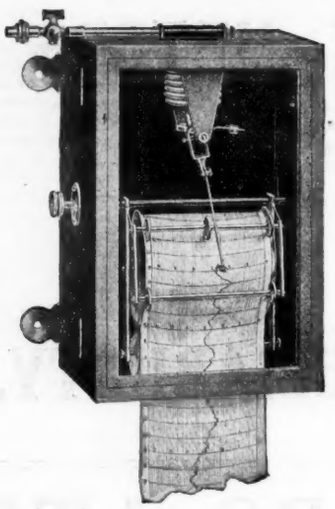

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# REGISTER OF PATENTS.

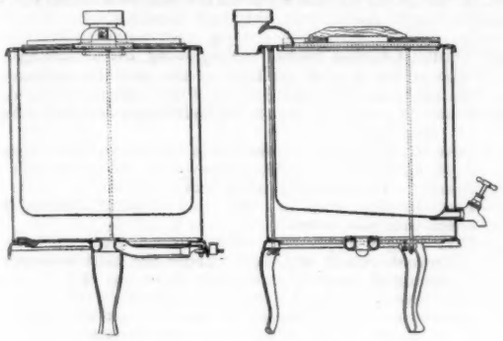
### Washing Boilers.—No. 251,785.

RADIATION LTD., of Birmingham, and YATES, H. J., of Grosvenor Place, S.W. 1.

No. 13,531; May 23, 1925.

The object of the invention is to provide an improved domestic wash-boiler of simplified construction.

The features are the employment of top and bottom rings between which the pan and an outer shell are contained, the rings being secured together by tie bolts, and the attachment of feet to the bottom ring partly by a short screw connecting the foot to the bottom ring



**A Radiation Wash-Boiler.**

and partly by the tie rods. Further, in each of the upper and lower edges of the shell a gap is formed. The upper gap receives the grooved periphery of a flue nozzle whereby the latter is attached to the shell, detachment being prevented by the top ring. The draw-off tap at the bottom of the pan passes through the other gap; and preferably the gaps are made alike so that either end of the shell can be placed uppermost.

In conjunction with the lower ring a transverse central bar is provided for the support of the main portion of the burner; the opposite end of the burner tube being carried on the supply nipple which is inserted through the ring.

We reproduce two sectional elevations of the boiler.

### Dry Cooling of Coke.—No. 251,530.

WUSSOW, R., of Charlottenburg.

No. 26,445; Oct. 22, 1925.

This invention relates to a method of dry cooling of coke and its application to a continuously operating gas producer. The method consists in passing a neutral gas or steam, or a mixture of both, in continuous circulation through a bed of coke to be cooled and through a saturator device with a finely divided spray of water; the gas and steam mixture heated in the layer of coke vaporizing a part of the water and carrying this freshly-formed steam with it through the layer of coke. The excess steam forms water gas in the upper high-temperature zone of the producer.

The invention is described and illustrated as applied, apparently, to a single-stage and to a two-stage gas producer.

### Gas Fires.—No. 252,042.

HELPS, G., of Nuneaton.

No. 873; Jan. 12, 1925.

The patentee calls attention to the known burner with a cap or head which can be moved so as to vary the amount of combustible mixture passing through the burner; a number of passages being formed in the head, which are unaffected by the movement of the latter. Such arrangements, he says, produce annular—*i.e.*, spread—flames, which are not suitable for use with gas fires.

According to this invention, a burner nozzle of the straight-flame type comprises a screen or tube adjustably mounted within the nozzle, whereby the area of the gas way can be varied, and gas passages in the screen or tube whose area remains unaltered.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF LORDS.

### Special Orders.

The Special Orders Committee reported that no petition had been presented against the following Orders, and there was nothing in the Orders to which they thought it necessary to call the attention of the House: Clitheroe Gas Order; Portsmouth Gas Order.

The following Orders were approved: Chapel Whaley and District Gas Order; Clitheroe Gas Order; Leatherhead Gas Order; Portsmouth Gas Order; Tawe Valley Gas Order.

The following Orders were referred to the Special Orders Committee: Dunstable Gas Order; Ellesmere Gas Order; Liverpool Gas Order; Seaford Gas Order.

### Progress of Bills.

Barnet District Gas and Water Bill: Reported from the Select Committee, with amendments.

A petition against the Guildford Corporation Bill has been presented by the Woking Water and Gas Company.

## HOUSE OF COMMONS.

### Special Orders.

A copy was presented of the Dunstable Gas Order.

The following Orders were approved: Chapel Whaley and District Gas Order; Leatherhead Gas Order; Tawe Valley Gas Order.

### Progress of Bills.

The Gas Light and Coke Company's Bill was reported, with amendments.

The Chorley Corporation Bill was read a second time.

The Halifax Corporation Bill, as amended, was considered, and further amendments made.

The Swindon Corporation Bill, as amended, was considered.

### Oil from Coal.

Replying for the Secretary of Mines to a question by Col. Applin, the Duchess of Atholl stated that experiments in the extraction of oil from coal by carbonization methods are being actively pursued in this country, both at the Fuel Research Station and by a number of firms and individuals. Extensive experiments on hydrogenating coal are being carried on in Germany. A number of British firms are represented in these experiments; and, by agreement, the Department of Scientific and Industrial Research obtain full information as to results, and a voice in determining the course the experiments are to take.

### Low-Temperature Carbonization.

Lord Eustace Percy, replying to Mr. William McLean Watson, said that, in the opinion of the Department of Scientific and Industrial Research, it was doubtful whether any of the existing schemes for low-temperature carbonization, though they contained many elements of promise, had as yet got beyond the experimental stage. Low-temperature carbonization could not as yet form part of any scheme for the re-organization of the coal trade. As soon as any process or processes of low-temperature carbonization were shown to be commercially practicable, it could not be doubted that private enterprise would rapidly develop them. In the meantime, the Department of Scientific and Industrial Research were carrying on their own investigation at the Fuel Research Station, and were giving assistance in testing results obtained elsewhere.

### Fuel Research.

Mr. Lawson asked the President of the Board of Education what amount of money was set apart in 1924 for the purpose of stimulating the activities of the Fuel Research Department, and how much of such money had been spent hitherto.

Lord Eustace Percy said in 1924 the Government authorized the Department of Scientific and Industrial Research to increase the annual expenditure on fuel research by a sum then estimated for 1925 at about £25,000, and for subsequent years at £35,000. The actual expenditure was £48,145 in 1924 and £76,241 in 1925, an increase of £28,000. The expenditure for 1926 was estimated at from £92,000 to £102,000—a total increase of £45,000 or more over the 1924 expenditure.

## NEWCASTLE-UPON-TYNE CORPORATION BILL.

This Bill was under consideration last week by a Committee of the House of Lords. It deals with various matters, and has a section concerning the sale of coke (see "JOURNAL" for Jan. 20, p. 162), to which there has been no alteration.

When the Bill was deposited, there were petitions by the Newcastle and Gateshead Gas Company and some electric supply companies, in respect of which, subsequently, agreement was reached. There is a clause in the Bill restricting the rights of public utility undertakers with regard to the breaking-up of streets. This provides that the Corporation, before commencing any work involving the closing of vehicular traffic of any street in the City, either absolutely or to the extent of one-third or more of the width of the carriageway, shall give three months' notice of their intention to execute such work to all undertakers having statutory powers to break-up the street, and that when the work has been executed by the Corporation it shall not be lawful for the undertakers, within twelve months of the completion of the work, to break-up the street without the consent of the Corporation. Such consent shall not be unreasonably withheld, and the Corporation may attach to any consent such conditions as may be reasonable with respect to the times at which, and the period within which, the work of the undertakers shall be executed and completed.

It is provided that, in respect of any work executed by any undertakers which, but for the provisions of this section, would have been lawful, the undertakers shall not be deprived of any right or immunity as between themselves and any person other than the Corporation to which they would have been entitled. Disputes or differences are to be referred to arbitration.

In a further proviso it is stated that nothing in the section shall prevent any undertakers from carrying out emergency works, or works necessary to enable them to perform their statutory duties, or their obligations under contracts subsisting at the date of the Corporation's notice, in default of which they would be liable to penalty or damages. Neither are they prevented from making, altering, repairing, or disconnecting communication pipes or service connections; laying service lines between premises and distributing mains; or altering, repairing, or disconnecting service lines.

# LEGAL INTELLIGENCE.

## HELPS v. OLDHAM CORPORATION.

**Tuesday, June 22.**

Sir ARTHUR COLEFAX, K.C., for the Corporation, submitted that the claim failed because they used nothing novel or unknown to the gas industry in 1918. They had already made blue water gas for diluting straight coal gas at their Central and Hollinwood Works. The utmost they did at Higginshaw, where the test plant was installed, was to dilute the gas by mixing air with it, then diluting the straight coal gas with the gas produced in this particular plant.

His LORDSHIP: Though the Corporation diluted before, with blue water gas, they had never done it to the extent they did after Mr. Helps had assisted them.

COUNSEL: What the Corporation did was to carry out a procedure previously adopted, continuing it after the time they met Mr. Helps. If Mr. Helps said that his liability under the guarantee arose only if some sort of exhaust was provided, he (Counsel) would reply that if the plaintiff required a particular method of running the works, he should have provided for it, and he had not done so.

His LORDSHIP: You say the Corporation never adopted the test-plant at Higginshaw, and that the processes which they actually operated were neither peculiar nor secret. The agreement, you say, never became effective because it was a test-plant which the defendants were at liberty to adopt or reject, and they never did adopt it. They have paid £10,583 for it, and have still £342 to pay to Gas Distribution, Ltd.; but they agreed to pay, and payment for the plant is not to be treated as adoption of the system. At the same time the plant was expected to become part of the regular installation.

COUNSEL said he thought there could be no doubt that Mr. Helps had the idea that he would make a gas which was substantially producer gas, but enriched in the course of manufacture with the products of the destructive distillation of coal. He was going to make what might be called a glorified producer gas enriched by distillation products. Counsel suggested that there was no evidence that this had been done. As to the counter claim, Sir Arthur said the Corporation claimed on a guarantee by Mr. Helps as to the output of his invention.

His LORDSHIP: This is under the proviso that, in the event of the Corporation not obtaining at least 15 million B.Th.U. from every ton of coal used, Mr. Helps agrees to pay a quarter of the cost of the plant.

COUNSEL submitted that the plant never did operate as designed to do. Any producer plant would yield up to 23 million B.Th.U. at that time used merely as a producer plant. What was there about this plant, Sir Arthur asked, not disclosed in Mr. Cotton's article in the "GAS JOURNAL" for March 26, 1918, p. 132? Mr. Helps might be able to make in his plant 15 million B.Th.U. of producer gas per ton of coal, but that was not enough; it must be an enriched producer gas. If he could not do that, he could not jump the first fence, and was liable to pay; one need say nothing about the second fence, and the question whether it was 15 or 13 million c.ft.

**Wednesday, June 23.**

Sir ARTHUR COLEFAX said the Corporation had utilized nothing of Mr. Helps's ideas except in so far as they used the test plant; and there it had to be said that the dilution of gas with air or water gas was known. It had been suggested that dilution with water gas was known early in the last century; and this process was all that the Corporation had used. Of course, in 1918 and earlier there was a considerable amount of research into the dilution of gas, with a view to its economic use; but the topic had practically been exhausted, and there was nothing left to discuss. After that it was all a matter of works practice. With over 1000 pages of printed shorthand notes before him, he proceeded to review the evidence of the experts called for the Corporation in the last eight days. As to Mr. Helps's burner, for low-grade gas, this simply gave a better chance of getting the quantity of air required for complete combustion.

His LORDSHIP observed that its advantage with low-grade gas was that it was more foolproof than the ordinary burner, and with it the consumer used less gas.

COUNSEL emphasized the contrast between the Nuneaton and the Oldham plants. That at Nuneaton was agreed to be substantially free from liability to blockage, whereas the evidence was strong that the Oldham plant was anything but free from this liability. It was significant that in the analysis of gas produced at Oldham, the figure 163 B.Th.U. so often appeared, which was the standard of producer gas. A figure of 180 B.Th.U. at Oldham would not be proof of the distillation of coal in the retort; and a witness had said that he saw no indication that the gas was enriched by the products of the destructive distillation of coal. Mr. Carr had said that, at Nuneaton, they made a typical producer gas. Mr. Carr said that, as early as 1910, they commenced to supply burners fitted with devices for regulating the supply of gas and air. As to the novelty of Mr. Helps's ideas, Mr. Carr said that when he read the account of his proposals in the "GAS JOURNAL," they called to his mind what he had read in the "GAS JOURNAL"—the journal that all gas engineers read—the year before, concerning what had been done in Germany.

**Thursday, June 24.**

Sir ARTHUR COLEFAX to-day ended his four days' final speech. He said there was a complete answer by an expert to the whole of Mr. Helps's position, when one realized, as Sir Dugald Clerk said, that the business of making and distributing lower-grade gas was exercising the minds of many people years before Mr. Helps ever touched the question—at any rate, long before the material date in this case. Sir Dugald said that, aiming at 400 B.Th.U., there was quite a group of patents attempting complete gasification.

His LORDSHIP asked Sir Arthur to formulate the points on which he desired a finding of the Court. He wanted, he said, to give judgment on the points on which the parties wished a decision. It was desirable that he should hear what both sides wished to have cleared up.

Sir ARTHUR COLEFAX framed the following list of findings.

1.—That at the date of the issue of the writ the defendants had not adopted the invention referred to in the licence agreement.
2.—That the period in which the defendants were to adopt had not been agreed on.
3.—That Mr. Helps did not disclose to anyone, for the Corporation, anything which in April, 1918, was a useful addition to the then existing knowledge of gas manufacture.
4.—That the defendants had not used anything disclosed by Mr. Helps that was novel.
5.—That the gas supplied by defendants had had pure blue water gas mixed with it, and their practice had been to supply a gas so diluted of a net calorific value above 335 B.Th.U. per c.ft.
6.—That there was no evidence that defendants had employed a gaseous mixture of hydrocarbon gas having a net calorific value of from 400 to 250 B.Th.U. at low pressure with coneless flames in close contact with the object heated.
7.—That burners were the subject of a patent not included in the licence agreement, and as far as used by defendants' customers were purchased by the Corporation from Mr. Helps.
8.—Defendants had not taken over the "Pleno" plant at the date of the writ.
9.—The plant had never to date of writ been run successfully on coal, despite everybody's attempts.
10.—That the plant was intended to operate as a complete gasification plant by distilling coal in the retort portion, such distillation being effected by the sensible heat of the producer gas formed in the lower part of the generator from the coke resulting from such distillation.
11.—That the plant cannot be made to operate as intended.
12.—That the plant does not infringe any claim of letters patent No. 156,812.
13.—That the plant operates only as a producer plant, and as such is badly designed and industrially impracticable.
14.—That the tests at Oldham were not conducted under conditions such as would obtain if the plant were run as its design showed it was intended to be run. In the solo test the conditions were not such as would permit it to be operated simultaneously with the straight coal gas plant as was intended.
15.—That the Oldham tests were adequate to establish that the plant can never be run to enable coal to be distilled therein or to enrich the producer gas produced therein.
16.—That Mr. Helps's guarantee in clause 4 of the licence agreement of June 4, 1919—that by using his invention defendants could obtain in the test plant 15 million B.Th.U. per ton of coal used—had not been, and cannot be, fulfilled.
17.—That £4257 9s. 3d. is due to the Corporation under that clause.

Sir ARTHUR COLEFAX said he would add to question seven, "That Mr. Helps's burner is suitable for use with either high or low grade gas, and that substantially equal efficiency is obtainable with either." To number 15 he would add: "That the tests at Oldham proved that there was no substantial distillation of coal, as shown by (*a*) temperature records; (*b*) gas analysis; and (*c*) calorific values."

Mr. WHITEHEAD, K.C. (for plaintiff), submitted that the licence agreement did not wipe out the other agreement, but only covered a portion of the ideas to which the agreement referred. The air which defendants added to their gas before meeting Mr. Helps at Higginshaw was for the purpose of purification only. The form of dilution they used was that which Mr. Helps suggested, and before the erection of the "Pleno" plant. Mr. Helps proposed to make a low-grade gas to dilute the ordinary gas. The ease of production of the coneless flame, which in his view was the most efficient flame from the thermal standpoint, was one of the advantages of the low-grade gas which he was advocating. Mr. Whitehead said he would argue that there was legal significance in the fact that the licence agreement covered only a portion of the ideas to which the agreement referred. It was important to notice that the invention referred to was in the singular, and was for the manufacture of low-grade gas in the methods indicated in patent No. 111,495, the main specification.

His LORDSHIP said he judged from the agreement for payment that it assumed that, if the tests were satisfactory, the plant would be adopted.

COUNSEL replied that until this case began there was never any suggestion that the invention was not adopted. That, however, was something different from the taking-over of the plant.

His LORDSHIP said he could not see in the document any obligation to adopt. Even if the tests were the best in the world, it seemed still open to the Corporation to decline to adopt.

COUNSEL: But I submit they cannot go on using the invention, and continue to deliver gas of a calorific value coming within the monopoly claimed, and then say, "We are not to pay royalties, because we have not adopted." The Corporation, after a month's trial, said the plant was very satisfactory. It had delivered low-grade gas

from then to this day. Though there might be no obligation on them to adopt, it was open to the Court to assume that there had been an adoption in fact; and this, he submitted, there had been.

**Friday, June 25.**

Mr. Helps was given leave to amend his pleadings so as to claim against the Corporation, not only in respect of gas manufactured at Higginshaw, but in respect of gas made at defendants' Central and Hollinwood Works, if it came within the calorific values of 400 and 250 B.Th.U.

Mr. WHITEHEAD claimed that dilution had been practised in the way actually contemplated in the claim of Mr. Helps's specification No. 111,495. The date when the invention was "installed and adopted" (in the meaning of the licence agreement) was the same for all three of defendants' works. Last year the supply of "better particulars" disclosed that, at Higginshaw, a low calorific value gas was made before the erection of plaintiff's plant, so that he must amend his claim, and go back beyond the date of the erection of the "Pleno" plant—Sept. 29, 1920—to the date of the first agreement, April 29, 1918. The dilution at Higginshaw had continued to the present time.

His LORDSHIP remarked that it would be as well to know, as far as possible, what the patent claims meant. Mr. Helps, in his patent No. 111,495, claimed the manufacture and employment of a gaseous mixture of a hydrocarbon gas with a diluent other than pure blue water gas and having a net calorific value of from about 400 to 250 B.Th.U. per c.ft., substantially as described. Did he claim royalties for all the gas manufactured by the Oldham Corporation, or in respect of the word "employed"—only that which the Corporation employed for their own benefit?

COUNSEL replied that he claimed for all that the Corporation manufactured and sold, for the word "employment" in the claim included selling.

His LORDSHIP said he was much puzzled about this patent.

COUNSEL made the comment that there was an erroneous figure in the specification. It was said that energy could neither be created nor destroyed, but Mr. Helps would have done it by a certain calculation.

His LORDSHIP: His gaseous mixture of a hydrocarbon gas is simply what we have called straight gas, so that he claims a gaseous mixture of straight gas with a diluent other than pure blue water gas, if mixed sufficiently to bring it down to 400 B.Th.U.

COUNSEL: It does not matter what the diluent is. Mond gas, producer gas, air, and nitrogen are mentioned. At Oldham they are using Mr. Helps's plant for producer gas, and the latter came within his claim of diluents. Claim 2 was for gas between 335 and 250 B.Th.U. diluted with pure blue water gas.

His LORDSHIP: Anyone who makes straight gas and dilutes it to a certain point comes within your claim. Anybody who takes a licence from you cannot mix his gas without paying you a royalty, whatever is to be said of the claim of the patent.

COUNSEL: No, it is not open to a person who takes a licence from me to say that the claim is bad. It is said that at the Central Works and at Hollinwood vertical retorts were employed, and that the gas generated, when coke was periodically steamed, was pure blue water gas; but it is agreed that it is never separated from the coal gas.

His LORDSHIP: At Hollinwood they have a blue water gas plant, and they mix the gas with straight gas. This does not come under claim 1. If they get down below 400 B.Th.U. by steaming and mixing blue water gas, is not that merely diluting with pure blue water gas?

COUNSEL: No, not even at the Central Works, because what was contemplated in the claim was a pure blue water gas manufactured separately. It never had a separate existence at the Central Works; there was also coal gas there.

His LORDSHIP: Momentarily it has a separate existence when it mixes with the coal gas in the retort.

COUNSEL: But that is not the pure blue water gas contemplated.

His LORDSHIP: What was the diluent with which the straight gas was mixed?

COUNSEL: Impure blue water gas. The vertical retort cannot generate pure blue water gas.

His LORDSHIP: What is the other admixture, if it is not straight gas with blue water gas?

COUNSEL: I cannot tell you the other admixture; but this is not the blue water gas specified. This gas is diluted with more than one diluent at all times. If there is a mixture of producer gas and pure blue water gas, it comes within the first claim.

His LORDSHIP: The agreement speaks of the works at which "the said invention shall be installed and adopted." The royalty on one view of the word installed seems to be related to the plant.

COUNSEL said that if the user employed coke he would be just as much a user of the invention as if the "Pleno" plant were worked with coal. It was useless for the Corporation to suggest that they used this plant only for testing purposes. They were still supplying gas on the verge of the claimed calorific values. Was it to be said that they were still testing and that they were entitled to go on testing for ever, and enjoying the benefit of immunity from fees? Was it never to be said that they had employed and adopted? It was not suggested that the plant would not yield 20 million B.Th.U. with coke. It was, however, said that the plant would not work commercially, and that there were blockages when coal was used. This plant was not meant to result in the complete distillation of coal, but he did not contest that it was expected there would be some distillation in the retort to make the glorified producer gas that Mr. Helps said he could obtain.

His LORDSHIP: The Corporation say that is the basis of the contract between you, and it has not been fulfilled.

COUNSEL: It does not matter, as far as the guarantee is concerned, whether there is distillation or not. It is a complete gasification plant by the generation of gases, in the production of which steam is used. It is not less a complete gasification plant because you call it a producer plant. The other side say it is a producer plant only.

His LORDSHIP: And a poor one at that. The Nuneaton plant, they say, is all right as a producer.

COUNSEL: But the "Pleno" plant is a complete gasification plant within the contemplation of the parties—that is the thing required. It was never thought by anybody that coal would be completely distilled. There was no more destructive distillation than took place in any producer plant.

His LORDSHIP said he was curious to know why the pull was varied when the test was going on.

COUNSEL said the practice was that generally in use, and was not peculiar to the test. It was to enable the quality of the town gas to be kept as constant as possible. The only way in which this could be done was by modifying the quantity of the "Pleno" gas; and there did not exist any other arrangement by which it could be accomplished.

**Monday, June 28.**

Mr. WHITEHEAD, concluding his speech, said four facts of importance had emerged in the week-end, as to which he desired to call fresh evidence. It had been suggested that the calorific values of Nuneaton were taken at the peaks of gas production. A witness for the Corporation—Mr. Carr—was asked if he suggested that the values were taken at these times in order to "boost" the figures. He answered that he made no such suggestion. In the week-end Counsel had found (1) that the plant at Nuneaton during the test worked in the same way as it was normally worked; (2) that the calorific value of the straight gas generated varied considerably; (3) that, in order to keep the calorific value of the mixed gas at about 280 B.Th.U., the necessary method at Nuneaton was to modify the quantity of "Pleno" gas; and (4) that modification was brought about by modifying the exhaust pull.

Sir ARTHUR COLEFAX said that to avoid calling fresh evidence he would accept Mr. Whitehead's new charts as showing honest working. The Oldham plant was said to be a replica of Nuneaton, so that Nuneaton might almost be eliminated from the case. Mr. Whitehead need not call any of his witnesses.

Mr. WHITEHEAD went on to say that the natural inference to draw from the chart he had had made of the record of publication during the 96-hour test, with the hours of the variation of the pull added, was this: The relationship of the times showed the calorific values were not taken at peak times any more than they were taken at other particular times, and that the average of the whole was a fair average of the calorific values. The pull was varied in order to keep the calorific value constant. His Lordship had asked why that could not be done by altering the governor so as to regulate the quantity of gas. The retorts for making straight gas at Nuneaton were horizontal retorts, and were fed intermittently with coal, so that the calorific value varied from 560 to 700 B.Th.U. At Nuneaton only a few retorts were in operation, perhaps 10. In the depth of winter they used 25 to 30; in the summer, 6. In modifying the pull on the "Pleno" gas, they got more or less "Pleno" gas in order to bring about the adjustment to 280 B.Th.U. The person who regulated did so by observing the calorific value recorder of the mixed gas. Above 280 B.Th.U., he put on more pull, and got a little more "Pleno." The variation of pull did not affect the straight gas.

His LORDSHIP asked Mr. Whitehead how he made out there was any distillation of coal, when the other side said, on the analyses, that there was none.

Mr. WHITEHEAD replied that experts on the other side had conceded to him that if there was distillation it might have the result of raising the calorific value; and he said that the increased calorific values were the result of distillation in the retort. Dr. Davidson said the tests at Oldham were wrongly conducted. Air was getting in; and it was plaintiff's case that the plant at Oldham was not tested properly.

His LORDSHIP: I think the air leaks ought to have been stopped.

Mr. WHITEHEAD said that at any rate the records showed that something perfectly extraordinary was happening, whatever it was. He did not accept the analyses, but put his evidence of destructive distillation on the calorific values. On Sir Arthur Colefax's evidence, there should not have been this difference between "A" and "B" gas. This Oldham test, Mr. Whitehead concluded, had gone wrong. Oldham should have worked like Nuneaton. He asserted, in contradiction to the defendants, that the Oldham plant would work commercially on coal, and its capability was to be tested with coal, though coke might be more economical. It had not been satisfactorily proved that it would not work on coal, though he did not say that a sincere attempt had not been made so to work it. Indeed, he said it had been commercially worked on coal.

On the counter-claim, he said the guarantee was that Mr. Helps's plant would give 15 million B.Th.U., and was suited for working with coal. The defendants said the plant would do it, and more, on coal, but not continuously or commercially. The onus was on them to prove this; and they had failed. There was no blockage which could not be cured by steam or liquor.

His LORDSHIP: Where introduced?

COUNSEL: You introduce the liquor at the top of the superheater, and the steam (besides the steam for production purposes) at the inlets into the main pipe at such points as practice shows desirable.

This, continued Counsel, was a test plant, the first of its kind to be built; and he asked the Court to find that, if the steam or liquor had been supplied, which Mr. Helps asked for, the blockages would not have occurred.

The hearing was adjourned.

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**Port Talbot Council and Gas Supply.**—On June 17 the Port Talbot Town Council decided against the purchase of imported coal for the production of gas. The available coal supplies will soon be exhausted.

# MISCELLANEOUS NEWS.

## GAS REGULATION ACT APPLICATIONS.

There have appeared in the "London Gazette" the following notices regarding applications to the Board of Trade under the Act.

### AMENDING ORDER.

**Farnham Gas and Electricity Company.**

The Farnham Urban District Council have made application under sub-section (3) of section 1 of the Act for an Amending Order revising the powers of charging authorized by the Farnham Gas (Charges) Order, 1922, by reducing the standard price prescribed by that Order.

### DECLARATION OF CALORIFIC VALUE.

**Tamworth Gas Light and Coke Company.**—500 B.Th.U. (Sept. 30.)

## SMETHWICK GAS DEPARTMENT.

Discussing the working of the gas undertaking of the County Borough of Smethwick in his report for the year ended March 31, Mr. Ernest Hardiker, the Engineer and Manager, states that, in spite of a slump in the market for residuals, the Committee have been successful in maintaining the average net price of gas at 2s. 9·7d. per 1000 c.ft. He records an increase in sales of 11 million c.ft., equal to 1·33 p.ct. The total quantity sold and accounted-for was 844 million c.ft. With regard to the distribution department, Mr. Hardiker remarks that the year has been one of great activity. The rapid growth of business has rendered the distribution premises inadequate, and the Committee have under consideration the erection of more commodious premises. During the year 695 fires and 760 cookers were fixed. The number of orders received totalled 15,947.

Mr. Sydney Taylor, the Borough Treasurer, in his accounts for the year, states that the net revenue from sales of gas was £118,655—an increase of £3204 on the previous year's figures. The number of ordinary meters fixed at the end of the year was 4328, and of prepayment meters 11,289. Regarding residuals, there was a decrease of 21·56 p.ct. in this year's return. The net profit for the year is £8619. Of the balance of £15,513 brought forward at the commencement of the year, £8322 was transferred to the special repairs and renewals account, leaving £7191. Adding to this the net profit of the current year, there is now an available balance of £15,810 in the net revenue account.

## LEEK GAS DEPARTMENT.

### Vertical Retorts and Carbonizing Wages.

In his annual report and analysis of revenue accounts for the year 1925-26, Mr. R. H. Ginman (Gas Engineer to the Leek Urban District Council) said that a most interesting comparison could be made between the results of this year's working and those of the year ended March 31, 1914, which was the year of his appointment. In the first place, this was the first complete twelve months' working of the Glover-West vertical retort plant, together with the newly-reconstructed works. The inclined retorts, which are now being demolished for the extension of the carbonizing plant, are completely out of action. The comparison shows the following points of interest: In 1914 stokers worked an average of 70 hours a week for £1 16s. 3d., whereas now they work 56 hours for £3 16s. 7d. Labourers worked 55½ hours a week for £1 4s., whereas now they work 47 hours for £2 9s. 9d. Yet manufacturing wages for carbonization then were 1·85d. per 1000 c.ft. of gas sold, whereas during last year's working they were 1·619d.

Mr. Ginman presented to his Committee a full analysis of accounts for the year 1925-26, compared with that for the year 1913-14. This comparison showed that the gas made had increased from 116,537,000 c.ft. to 171,884,000 c.ft.; and the make per ton had increased from 11,350 c.ft. to 19,013 c.ft. (or 88 therms). The unaccounted-for gas had been reduced from 8·6 p.ct. to 5·7 p.ct., while the total weight of coal carbonized had actually decreased from 10,267 to 9040 tons.

In comparing the results with the previous year's working, it is seen that the net cost of coal was £5591 for the year ended March 31, 1926, as against £7242 (a saving of £1651), in spite of the fact that lower prices were received for coke, tar, and ammonia; the improved yields from the vertical retort plant more than making good the reduction in prices for residuals. The increased sale of gas for the last twelve months was 13,363,000 c.ft., or 9·31 p.ct. on the previous year's sales. There was a net increase of 101 consumers.

Commencing at April 1, 1925, the price of gas to all consumers was reduced by 3d. per 1000 c.ft., representing a sum of £1856 on the year's sales. To mark the centenary of gas in Leek, a further reduction of 3d. per 1000 c.ft. was made for the March quarter, 1926, representing a further sum of £566 in the year's accounts. The price of coke was also reduced by 1s. 8d. per ton in May, 1925. The gross profit this year amounts to £6991, against £2538 last year, leaving this year a net profit of £761. This net profit can be considered very satisfactory, when it is found that during the year 100,405,300 c.ft. of gas were sold at an average price of 2s. 9d.

In view of the 9·31 p.ct. increased sales of gas, the Lighting Committee deemed it advisable to extend the carbonizing plant, and an order was placed with West's Gas Improvement Company for the immediate provision of a further half million c.ft. a day Glover-West vertical retort plant, making a total provision for 1 million c.ft. a day.

The Lighting Committee considered the report highly satisfactory; Mr. Ginman being warmly complimented on the results.

## ASSOCIATION OF PRIVATE OWNERS OF RAILWAY ROLLING STOCK.

The Thirty-Fifth Annual Meeting of the Association was held at the Midland Grand Hotel, London, on Wednesday, June 23, under the presidency of Mr. JOHN CHARRINGTON (the Chairman).

In moving the adoption of the Committee's report and balance-sheet for the past year, the CHAIRMAN commented on the satisfactory financial position of the Association, and reported a still further increase in membership. At the same time he pointed out that, in order to maintain and promote the interests of private ownership to the fullest extent, every private owner should be enrolled as a member; and he expressed the hope that any who had not done so would apply to join without delay. He then referred in detail to the various matters of great importance and intricacy that had been dealt with successfully by the Committee during the past year.

The resolution was heartily supported, and appreciation expressed of the work done; and it was then passed unanimously. Cordial votes of thanks to the Chairman and Committee for their valuable services during the year were also proposed, and carried unanimously.

Applications for particulars and terms of membership may be sent to the Secretary, Clarence Chambers, Gloucester.

## STOKE-ON-TRENT GAS DEPARTMENT.

In his report for the year ended March 31, Mr. A. Mackay, Chief Engineer and General Manager of the Stoke-on-Trent Gas Department, states that the undertaking continues to make satisfactory progress, the quantity of gas manufactured for the year being 1428 million c.ft., as against 1394 millions last year—an increase of 34 million c.ft. Housing schemes being carried out in the city are causing increased business for the Department. The increase on the slot meters alone for the year is over 54 million c.ft.

During the year, 84,122 tons of coal were carbonized, compared with 91,833 tons last year. This reduction was due to the greater use of the carburetted water gas plant. A further cause was the greater efficiency of the plant at the Etruria Works. The gas made per ton of coal in 1924-25 was 18,027 c.ft., while for 1925-26 the figure has been increased to 19,274 c.ft., and the therms per ton have been increased from 65½ to 67½.

The general financial results, continues Mr. Mackay, have been most satisfactory, the total expenditure being £226,918, compared with £250,099 last year. The total revenue for the year was £290,812, as against £301,216—a reduction of £10,403, accounted for by the reduced revenue from residuals. The result of the year's working is a carry-forward to the profit and loss account of £63,893, against £51,116 last year—an increase of £12,777.

During the year energies have been exerted in connection with the new chemical works on which the Ministry of Health granted a loan, with the result that an entirely new chemical works has been erected on a piece of land adjoining the Etruria Works. New coal storage has also been completed, and new railway sidings have been laid down during the year, including railroads for the coal stores, tar works, and sulphate of ammonia works. Mr. Mackay states that the major portion of the loan in connection with the second part of the centralization scheme has now been granted. This includes a vertical retort installation, together with purification plant.

It is confidently anticipated that in the winter of 1927 the additional new plant will be put into action.

## PLYMOUTH GAS LIGHT AND COKE COMPANY.

At the Plymouth and Stonehouse Gas Light and Coke Company's meeting, Mr. J. H. ELLIS, Chairman and Managing Director, said the sales of gas were 4 p.ct. more than for the previous year. The output was 1643 million c.ft., which was 200 million more than when he addressed them from the chair eight years ago. The increased sale of gas appliances was even more satisfactory, more than six times the volume of business being done now than eight years ago. There had been an issue of stock last September, and it had been a great success, 80 p.ct. having been subscribed locally.

Proposing the adoption of the report and accounts, Mr. Ellis said that the past year had been one of grave and exceptional anxiety, overshadowed by the uncertainties and perplexities of the dispute in the coalfields, which culminated in the stoppage from which the country was now suffering. When the strike came it found them with ample stocks and clear and definite plans for the protection of the public throughout their supply area against the hardships the strike was designed to inflict upon them. He was glad to be able to assure the meeting that, though the stoppage had lasted eight weeks, they had sufficient coal to maintain the gas supply for another eight weeks, and more. It would be agreed that the harassing times through which the Board had passed, and were passing, had not impaired the high reputation which the Company had so long enjoyed, but that the measures taken had enhanced the Company's stability and materially strengthened their capacity for public service. It was possible to pay the same dividends as last year. The Chairman concluded with a tribute to the work of Mr. P. S. Hoyte (Engineer), Mr. G. H. Bolton (Secretary), and the staff and employees.

On the motion being seconded by Mr. T. G. GREEK WILLS, the report was adopted.

The balance standing to the credit of the profit and loss account amounted to £29,367. The Directors recommended the payment therefrom of a dividend for the half-year to March 31 last of

£7 17s. 6d. p.ct. per annum on £188,120 ordinary stock; 13s. 3d. per share on 7000 additional shares; and 12s. 9d. per share on 3000 "New Shares Act, 1879;" and for four months to March 31 last at the rate of £7 17s. 6d. p.ct. per annum on £67,042 ordinary stock issued in 1925, less income-tax. This would absorb £15,772, leaving £13,594 to be carried forward to the credit of the next account. The recommendation was agreed to.

## CO-PARTNERS AND THE GENERAL STRIKE.

Dr. Charles Carpenter, the President of the South Metropolitan Gas Company, contributes to the June issue of the Company's "Co-Partnership Journal" the following comments on the subject of co-partners and the general strike:

The great strike, which began and ended so dramatically, cannot be regarded as having tested the co-partnership of the gas industry, except to a very limited extent; for, unlike the employees of electrical supply undertakings, gas workers in general were left undisturbed in their employment.

In other industries there was a direct challenge to the principles of co-partnership; a notable instance being that of Messrs. Brunner, Mond, & Co., at whose chemical works the employees, 10,000 in number, refused to obey the strike order, and remained at work. Co-partnership principles are well established in this great business, and at a recent conference in Birmingham Sir Alfred Mond bore testimony to the good feeling between the men and the firm.

A duty is incumbent on co-partners, which is, indeed, involved in the co-partnership principle—the duty of those who have long enjoyed its blessings to pass on to their fellow-workers, to the best of their ability, a knowledge of what co-partnership really stands for. It has provided machinery which, during over a third of a century, has been carrying out in every-day life, in the particular business in which we are engaged, principles which labour claims to have voiced for many years. But it is up to the employees to see that the fullest use is made of that machinery, and that it functions efficiently in the manner for which it was designed.

The ideals for which trade unions were originally formed have much in common with the objects of the co-partnership movement; but co-partnership principles are incompatible with industrial strife, and particularly with what is known as the "sympathetic strike." Some years ago I pointed out that there was better work to the hands of trade unions than that of organizing strikes. It was said of the great war that it was a war to end war. Has the great strike in its turn proved the futility of strikes? If it has, the waste of labour and money that it has entailed will not have been in vain.

## ACROBATIC MOTOR LORRY.

The photograph reproduced herewith relates to a remarkable accident which took place last week on the Coventry Road between Birmingham and Coventry, in which a motor lorry of the Parkinson Stove Company, Ltd., of Stechford, was involved. The driver of the lorry, who was dazzled by the headlights of an on-coming motor-car, pulled too far into the side of the road. The lorry then fell into a ditch, with the result that it went through the hedge and over a bank into an adjoining field, the level of which was

about 25 ft. below the roadway. The lorry rolled over and over down the incline, turned three complete somersaults in its course, finally pitched out all the contents (which consisted of a large number of gas stoves), and then righted itself as shown. The stoves were part of a consignment which was being conveyed from the works to several places in Kent.

As will be seen, very considerable damage was done, but fortunately (a strange and providential feature of the mishap) the driver escaped with no worse injury than a shaking and a few superficial bruises.

**Gas Controllers at Oldham.**—The use of gas controllers for the public lamps at Oldham has been an unqualified success. The quantity of gas saved by this system last year was 5 million c.ft. The amount expended on mantles has been reduced by £150.

## COAL TRADE IN THE MIDLANDS.

**From Our Local Correspondent.**

With the pits idle it is impossible, of course, to make any progress with negotiations as to the new year's contracts for gas coal. July finds probably the larger proportion of the consumption unprovided for. It is estimated that from 45 to 50 p.ct. of the gas coal for the twelve months on which we have now entered has been contracted for. The prices arranged, 1s. 6d. or more below last year's contract rates, are regarded as placing the buyers in a favourable position, though it is impossible, in existing circumstances, to forecast the course of the market. Stocks at some of the undertakings have reached a point which causes perturbation, but the more important concerns in this district have still a good margin of safety. Curtailment of services must soon become much stricter should the impasse continue.

More men are returning to Midland pits, where emergency agreements have been reached. At over a dozen Warwickshire collieries a resumption has been made, though in the majority of cases operations are on a very small scale. At the Highley Colliery, between Kidderminster and Bridgnorth, the normal output of 750 tons per day has been restored. At Brereton, Cannock Chase, where between 400 and 500 men had applied for re-engagement, pressure has been exercised by the Federation to prevent a schism. In other localities intimidation is deterring men from working. Both in Staffordshire and Shropshire appreciable tonnages are being raised at "candle pits" and other outcrop workings. Coal from the Continent is now being introduced into the Midlands to relieve the industrial stringency.

## YORKSHIRE AND LANCASHIRE COAL TRADE.

**From our Local Correspondent.**

Many of the gas concerns are now coming into the market for foreign coal in limited quantities to augment their depleted stocks of home fuel. So far not a great amount of imported coal has come to hand, although it is anticipated that during the next few days arrivals will be considerable.

There appears to be no cause for any great anxiety, as there is a sufficient volume of tonnage available for some time to come. There is, unfortunately, some delay in delivery, especially as the nearer Continental exporting countries are not in the habit of shipping coal, but rather the reverse.

Prices are on the upward tendency; the latest figures showing that American unscreened gas coal of the best qualities is available at from 37s. c.i.f. at the ports.

## CURRENT SALES OF GAS PRODUCTS.

**The London Market for Tar, Tar Products, and Sulphate.**

LONDON, *June* 28.

The London Market for tar products is quite firm. There is no large amount of pitch buying for next season, and the price is nominal at about 80s. per ton.

Creosote is in demand, and there are buyers for shipment well forward. The price is firm at 7¼d. to 7⅜d. per gallon net and naked at makers' works.

All white spirits are decidedly firmer; pure benzole and pure tuluole being from 2s. 6d. to 2s. 9d. per gallon. For 95/160 solvent naphtha, 2s. 3d. per gallon is quoted.

Pyridine bases is steady at about 20s. per gallon.

**Tar Products in the Provinces.**

*June* 28.

Markets for tar products have remained steady throughout the past week, and in one or two instances prices have improved.

Pitch remains firm, with a fair amount of inquiries for near and forward delivery, although buyers are still unwilling to pay the high prices asked for the forward position.

Creosote is firm.

Benzole and solvent naphthas are in good demand.

The average values for gas-works products during the week were: Gas-works tar, 52s. 3d. to 57s. 3d. Pitch, East Coast, 77s. 6d. to 80s. f.o.b. West Coast—Manchester, 71s. to 73s. 6d.; Liverpool, 72s. 6d. to 75s.; Clyde, 77s. 6d. to 80s. 6d. Benzole, 90 p.ct. North, 1s. 9d. to 1s. 10d.; crude, 65 p.ct. at 120° C., 1s. 1½d. to 1s. 2½d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 9d. to 1s. 10d. Toluole, naked, North, 1s. 8d. to 1s. 9d. nominal. Coal-tar crude naphtha, in bulk, North, 8½d. to 8¾d. Solvent naphtha, naked, North, 1s. 6d. to 1s. 7d. Heavy naphtha, North, 11½d. to 1s. 0¼d. Creosote, in bulk, North, liquid, 6½d. to 6¾d.; salty, 5⅞d. to 6d.; Scotland, 5⅝d. to 5⅞d. Heavy oils, in bulk, North, 7½d. to 7⅝d. Carbolic acid, 1s. 4d. to 1s. 5d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

**Dearer Gas at Runcorn.**—The price of gas to all consumers in Runcorn, both industrial and domestic, is to be increased by 1½d. per therm. Discounts are to be allowed for prompt payment; but the rebate to prepayment consumers is to be discontinued. The increase is due to the rise in the price of coal, and is only a temporary one.

**Warrington Gas Department.**—The gross profit for the year ended March 31, we learn from Mr. A. Cook, the Engineer and Manager, was £21,014, which, after deducting sinking fund and interest charges, leaves a net profit of £6573. The output of gas was over 619 million c.ft.—an increase of 9·3 p.ct. During the year, over 1000 cookers were installed.

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## TRADE NOTES.

**Cockey Purifiers and Livesey Washers.**

Messrs. Edward Cockey & Sons, Ltd., of Frome, have received orders from the Gloucester Gas Light Company for a set of four 40 ft. square elevated cast-iron purifiers, complete with steel building, Cockey patent reversing central valve and connections; from Messrs. J. C. Lanyon & Co., for South Australia, for two 2 million c.ft. capacity Livesey washers; and from the Gas Light and Coke Company, two 1½ million c.ft. Livesey washers for their Harrow Works.

**The Steel Band Conveyor & Engineering Company, Ltd.**

From July 1, this Birmingham firm are acquiring the assets and goodwill of the business carried on up to the present by Steel Belts, Ltd., of Manchester. The former firm are transferring the stock and tools, &c., to their extensive works in Birmingham, where they have a sound organization. Mr. H. Blackburn, who has hitherto been Managing Director of Steel Belts, Ltd., will join them, and remain in Manchester to attend to the many customers in Lancashire and Yorkshire.

**Coal Handling Plant for Barking.**

Messrs. Robert Dempster & Sons, Ltd., have secured an order from the County of London Electric Supply Company, Ltd., for the coal handling plant, comprising two 100 tons per hour gravity bucket conveyors, and a 25-ton per hour telpher plant over storage bunkers, for the extension of their electric super-power station at Barking. The same firm supplied the coal handling plant over the bunkers, and the whole of the ash handling plant for the boilers, for the first installation of this station in 1924.

## CONTRACTS OPEN.

**Vertical Retort Installation.**

The Gas Committee of the City of Stoke-on-Trent are inviting tenders for a continuous vertical retort installation. [See advert. on p. 747.]

**Tar and Liquor.**

Tenders are invited by the Gas Committee of the Loughborough Corporation for the purchase of surplus tar and ammoniacal liquor. [See advert. on p. 747.]

The Gas Committee of the Penrith Urban District Council are inviting tenders for the purchase of surplus tar. [See advert. on p. 747.]

**Increase in Price by the Commercial Gas Company.**—The Commercial Gas Company are increasing their charge for gas by two-fifths of a penny per therm.

**Price Increased by South Metropolitan Gas Company.**—The Company announce a temporary increase in the price of gas—from 8¾d. to 9¼d. per therm. This is made necessary by the heavy cost of importing coal from abroad, due to the continued stoppage in the mining industry.

**British Dyestuffs Corporation.**—The Directors announce that the profits of the British Dyestuffs Corporation for the year ended March 31 last amount to £253,517. They propose to set aside £80,000 for depreciation on plant and buildings, and to recommend a dividend of 2½ p.ct., less tax, leaving £78,006 to be carried forward.

**Lighting of Stairways of Tenement Buildings.**—The General Purposes Committee of the London County Council recommend that legislation be promoted in the 1927 session of Parliament to impose an obligation on owners of tenement buildings (not including a house to which sections 6 and 7 of the Housing Act, 1925, apply) to provide and maintain adequate means of lighting the common staircases, including landings and passages, of such buildings.

**Cheaper Industrial Gas at Bingley.**—A reduction in the price of gas supplied for industrial motive power of 6d. per 1000 c.ft., from July 1, has been announced to the Bingley Urban Council, by Mr. J. Clarke (Chairman of the Lighting Committee). This, he said, along with the adoption of the proposed sliding-scale for discount on gas, would mean a loss to the revenue of the Department of £628. After carefully investigating the position of the Department, he was convinced that the concession could be made.

**Burnley Public Lighting.**—The number of public lamps maintained by the Burnley Lighting Department is 3870. The annual report of Mr. J. H. Clegg (the Engineer and Manager to the Gas Department) states that there is a reduction of 7200 in the number of mantles used. The reduction is due to the adoption of No. 2 burners, as the smaller mantle is less liable to breakage, to the adoption of controllers, preventing the damage of mantles by lamplighters' torches, and to the increased efficiency of the Department.

**Asphalted Road.**—The progress in road surfacing was the subject of a paper entitled "Some Further Notes on Asphalt," read by Mr. W. J. Hadfield, City Surveyor of Sheffield, at the annual meeting of the Institution of Municipal and County Engineers at Bristol. Few, he said, would dissent from the view that for modern traffic a smooth surface was necessary. If so, what substantial alternative was there to tar macadam for the provincial road with medium traffic, or some form of asphalt for a similar road with heavy traffic? Many statements had been made about the number of accidents occurring on asphalted roads, and there had been a disposition to judge such surfaces generally from exceptional cases. He could give actual figures as to what occurred in Sheffield, with 400 miles of highway, and 650,000 yards of asphalt, during the six months from September, 1925, to March, 1926. The number of accidents recorded in those six months was 84, by no means all of which were on asphalt. None of them was serious, and compared with the traffic the total was very small.

## Oldham Gas Department.

The annual report of Mr. Ernest Parry, the Commercial Superintendent of the Oldham Gas Department, states that the net profit for the year was £11,419, which, taking into account the debit balance brought from the previous year, and the amount contributed to the borough fund, leaves a debit balance of £34,384. The net price realized per 1000 c.ft. of gas sold during the year was 3s. 1·86d., compared with 3s. 2·18d. in the previous year. The quantities of gas manufactured at the different stations during the year were: Oldham, 216 million c.ft.; Higginshaw, 612 millions; Hollinwood, 880 millions. The total make, 1708 millions, was a record for the undertaking, being 85 million c.ft. in excess of the previous year's make. The total number of meters fixed on March 25 was 59,259—an increase of 1260. Cooking stoves and grillers in use on the same date totalled 29,322—an increase of 1396. The increase in gas fires was 1362, bringing the total to 7652, excluding those owned by consumers. The number of gas wash-boilers in use on hire terms was 1762. There has been an increase in the quantity of gas consumed in houses and shops of 80,731,700 c.ft., and in mills and workshops of 2,191,600 c.ft., a total increase of 6·35 p.ct.

## Low-Temperature Carbonisation Capital.

An extraordinary general meeting of Low-Temperature Carbonisation, Ltd., was held on Tuesday, June 22, when resolutions were confirmed which sanctioned (1) the reduction of the capital from £1,275,000 to £162,150 10s., to be effected by cancelling capital to the extent of 2s. 6d. per share on the "A" preference shares, to the extent of 17s. 6d. on the participating preference shares, and to the extent of 18s. per share on the ordinary shares, reducing the nominal amount of the "A" preference shares to 7s. 6d. each, the participating preference shares to 2s. 6d. each, and the ordinary shares to 2s. each; (2) the sub-division of each of the "A" preference shares into fifteen shares of 6d. each, each of the participating preference into five shares of 6d., and each of the ordinary shares into four shares of 6d.; (3) the consolidation of the three classes of shares into one class, consisting of ordinary shares of 2s. each; (4) the subsequent increase of the capital of the Company to £1,275,000 by the creation of 11,128,495 new ordinary shares of 2s. each, the new shares to be at the disposal of the Directors for the purpose of carrying into effect the scheme of arrangement proposed to be made between the Company, Gas and Fuel Plants, Ltd., and the Barnsley Smokeless Fuel Company, Ltd.; (5) the necessary alterations to the articles of association; and (6) the approval of the scheme of arrangement. Col. N. G. Thwaites, who presided, said, in reply to a shareholder, that they should get an output by the end of November, if nothing intervened, and there were no labour troubles.

**Gas Supplies in Glasgow.**—The Gas Department of the Glasgow Corporation have decided to refrain from putting into operation the rationing scheme which was proposed by the management a fortnight ago. The strictest economy, it is pointed out, is more needful than heretofore.

**Aldershot Debenture Stock Issue.**—On tenders being opened for the £50,000 of 4 p.ct. perpetual debenture stock offered by Messrs. A. & W. Richards on behalf of the Directors of the Aldershot Gas, Water, and District Lighting Company, it was found that the amount applied for was £192,380, at prices ranging from £80 down to the minimum of £72 p.ct. The lowest successful tender was at £73 10s., and the average price obtained was £73 18s. 1d. p.ct.

At a meeting of the Plymouth Gas Committee on Thursday last it was reported that the output at the Corporation Gas-Works during May showed a decrease of 2·42 p.ct.

An interesting cricket match took place on Wednesday evening last, June 23, between the Metrogas A.S.A. and H.M. Fuel Research C.C. The Metrogas team were fortunate in winning the toss. Their first two batsmen—P. Parrish and H. C. Barrell—scored at a rapid rate, compiling 103 in three-quarters of an hour, when they decided to retire. The total score was 162 for eight wickets. The Fuel Research Station did not fare too well against the excellent bowling of Eggleton and Jennings; and their score was 57.

The annual outing of the warehouse staff of the Farringdon Road Branch of Messrs. Falk, Stadelmann, & Co., Ltd., took place on Saturday, June 26, when a party of upwards of 450 were taken by special train from Holborn Viaduct Station to Margate. Mr. Max Falk (Chairman of the Company) received his guests at the mid-day meal, after which the party dispersed until their return by "special" to town in the evening. Favoured with ideal summer weather, the excursion proved one of the most enjoyable of recent years.

On June 16, in connection with the English Bowling Association, there was a match, at Luton, between the South African Bowlers and the Bedfordshire County Club. The visitors were welcomed by the Mayor of Luton, Alderman Albert Wilkinson, and Mr. H. N. Davis, Managing Director of the Davis Gas Stove Company, Ltd. The Davis Company entertained the South African team and other visitors at luncheon, and Mr. Davis invited the visitors to tour the works, and to see the various processes in the transformation of pig iron into the highly-finished stoves. The match resulted in a narrow victory for Bedfordshire. Afterwards the visitors and their lady friends were entertained to dinner by Mr. Davis. Mr. Allwood spoke in glowing terms of the support Mr. Davis gave to the County Association, and of the manner in which the Davis staff rallied to the support of the Association at all times. In responding, Mr. Davis pointed out that the Davis Athletic and Social Club was run entirely by the employees of the firm. As to the good spirit existing in the works, he said it was true that a head was necessary if a business was to be run efficiently and properously, but it was also possible to have a heart. What prosperity the Davis Company had enjoyed was due to recognition of the latter fact.

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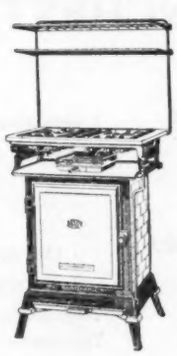

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# STOCK MARKET REPORT.

WHILE business on the Stock Exchange continued active last week, it was largely confined to "specialities," and profit taking caused considerable price fluctuations. New issues were again prominent; but they have not been uniformly successful. The £1,500,000 5 p.ct. Bradford Loan met with a good reception; but heavy "stagging" defeated the object of these subscribers, and a nominal premium only is obtainable. The huge Australian Loan was not received well, and 61 p.ct. was left with the underwriters.

The problem of the French finance continues to dominate the Foreign Market, and it is hoped that the new Government will have the backing which is necessary to re-establish French credit. Home Rails continued uninteresting, the poor traffic returns not being conducive to higher prices.

In the Gas Market there were signs of further improvements. The Gas Light ordinary and both the Commercial Company's stocks were marked up a point. The announcement, in consequence of the high prices being paid for foreign coal, by the South Metropolitan Company is unlikely to depreciate the value of that Company's stock, as it is not expected to affect the dividend. The Commercial Company have also announced an increase of $\frac{3}{8}$d. per therm; and on the present standard this variation reduces the authorized dividends to £5 1s. 4d. and £4 16s. 8d. p.ct. per annum on the 4 p.ct. and 3½ p.ct. stocks respectively. Rumour has it, however, that an application is being made to the Board of Trade for a revised standard with every prospect of success. It will be seen by the table that there is the usual end of the half-year *ex* interest reductions on the debenture stocks.

The following transactions were recorded during the week:

On Monday, Bombay 20s., Commercial 4 p.ct. 79, Continental Union 7 p.ct. preference 87, Gas Light and Coke 85, 85¼, 85⅛, 86, 4 p.ct. preference 77, 77⅜, Imperial Continental 123½, 124, Primitiva 9s. 6d., 9s. 10½d., 10s. 1½d., South Metropolitan 94, South Suburban 5 p.ct. debenture 96⅝. Supplementary prices, Romford "B" 8⅛, 8⅜.

On Tuesday, Commercial 4 p.ct. 78, 3 p.ct. debenture 56, Gas Light and Coke 85, 85⅛, 85⅜, 86, 3½ p.ct. 59½, Hastings and St. Leonards 3½ p.ct. 70, Imperial Continental 124, 124½, 125, Primitiva 9s. 7½d., 9s. 9d., 10s., 4 p.ct. debenture 85, San Paulo 6 p.ct. preference 7⅞, 5 p.ct. debenture 45, South Metropolitan 93½, 94½, Southampton 79, 79⅜. Supplementary prices, Derby 5 p.ct. 106, 106½, Southend-on-Sea 5 p.ct. new "B" 81, 81½.

On Wednesday, Bombay 20s. 3d., Gas Light and Coke 85, 85⅛, 85⅛, 85⅜, 85⅜, 86, 86⅛, 86⅛, 86⅛, 3½ p.ct. 58¾, 59½, 4 p.ct. preference 77⅜, 3 p.ct. debenture 59, Imperial Continental 126, Primitiva 9s. 7½d., 9s. 9d., 10s., South Metropolitan 93½, 93¾, Wandsworth, Wimbledon 5 p.ct. 102¾. Supplementary prices, Barnet "D" 103.

On Thursday, Commercial 3 p.ct. debenture 55, European 5, Gas Light and Coke 86, 86⅛, 86⅛, 87, 4 p.ct. preference 77, 3 p.ct. debenture 58½ *ex* div., Imperial Continental 124, 125, 126, South Metropolitan 93¾, 94⅜. Supplementary prices, Barnet "D" Water Stock 104, Brighton and Hove 5 p.ct. debenture 92½.

On Friday, Bombay 20s., European 5½, Gas Light and Coke 85⅛, 85⅜, 86⅛, 86⅜, Imperial Continental 124, 126, Oriental 100, 100½, Primitiva 9s. 6d., 9s. 7½d., 9s. 9d., 10s., South Metropolitan 93¾, 94, 6½ p.ct. debenture 102½. Supplementary prices, Barnet "D" 104.

With the usual end of the half-year borrowings from the Bank of England, the Money Market was plentifully supplied with money, and while the renewal rate remained unaltered at 3½ p.ct., day-to-day loans were in a few cases arranged at under 3½ p.ct. Discount rates were somewhat firmer, and the average for Treasury Bills showed a reduction of about 4½d. p.ct. at £4 5s. 0·93d. p.ct.

Large dealings were reported in French francs, and very erratic movements occurred in consequence. There was, however, a distinct improvement on the previous week's quotations, and the rate finally closed at 168½. The Belgian rate was again higher than the French exchange, and closed at 170⅜. Italian lire recovered slightly to 133⅝, and sterling on New York was firmer at the close, finishing at 4.86 .

The price of silver was slightly easier at 30⅞d. per oz., and gold remained at the nominal price of 84s. 11½d. per oz. with no gold available.

The Bank rate is 5 p.ct., to which it was raised from 4 p.ct. on Dec. 3. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3¼ p.ct. at notice.

| Issue. | Share. | When ex-Dividend. | Dividends. Prev. Hf. Yr | Dividends. Last Hf. Yr. | NAME. | Quotations. June 25. | Rise or Fall on week. | Transactions Lowest and Highest Prices. |
|---|---|---|---|---|---|---|---|---|
| £ | | | % p.a. | % p.a. | | | | |
| 171,978 | Stk. | Feb. 4 | 5 | 5 | Aldershot 5 p.c. max. C. | 74—77 | .. | .. |
| 322,992 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. | 69—74 | .. | .. |
| 1,551,868 | ,, | Apl. 1 | 6¼ | 6¼ | Alliance & Dublin Ord. | 75—80 | .. | .. |
| 374,000 | ,, | Jan. 7 | 4 | 4 | Do. 4 p.c. Deb. | 60—65 | .. | .. |
| 300,000 | 1 | May 6 | 1/7⅛ | 1/7⅛ | Bombay, Ltd. | 1/—1/1 | .. | 20/—20/8 |
| 170,000 | 10 | Mar. 4 | 8½ | 8½ | Bournemouth 5 p.c. | 12—13 | .. | .. |
| 425,050 | 10 | ,, | 7 | 7 | Do. B 7 p.c. | 12—12½ | .. | .. |
| 275,000 | 10 | ,, | 6 | 6 | Do. Pref. 6 p.c. | 11—12 | .. | .. |
| 50,000 | Stk. | June 24 | 3 | 3 | Do. 3 p.c. Deb. | 54—57* | −1 | .. |
| 162,025 | ,, | ,, | 4 | 4 | Do. 4 p.c. Deb. | 74—77* | −1 | .. |
| 214,740 | ,, | Mar. 18 | 12 | 12 | Brighton & Hove Orig. | 167—172 | .. | .. |
| 244,200 | ,, | ,, | 9 | 9 | Do. A Ord. | 125—133 | .. | .. |
| 1,287,500 | ,, | Feb. 18 | 5 | 5 | Bristol 5 p.c. max. | 86—89a | −½ | .. |
| 855,000 | ,, | Mar. 18 | 8 | 7 | British Ord. | 99—104 | .. | .. |
| 100,000 | ,, | June 24 | 7 | 7 | Do. 7 p.c. Pref. | 114—119* | −3 | .. |
| 120,000 | ,, | ,, | 4 | 4 | Do. 4 p.c. Red. Deb. | 68—73* | −1 | .. |
| 100,000 | 10 | June 10 | 6 | 8 | Cape Town, Ltd. | 6½—7½ | .. | .. |
| 100,000 | 10 | Apl. 22 | 4½ | 4½ | Do. 4½ p.c. Pref. | 5⅞—6⅞ | .. | .. |
| 150,000 | Stk. | June 24 | 4½ | 4½ | Do. 4½ p.c. Deb. | 66—71* | −2 | .. |
| 626,860 | ,, | Feb. 18 | 6 | 6 | Cardiff Con. Ord. | 96—99 | .. | .. |
| 237,860 | ,, | June 24 | 7½ | 7½ | Do. 7½ p.c. Red. Deb. | 98—101* | .. | .. |
| 157,150 | ,, | Mar. 4 | 5 | 6½ | Chester 5 p.c. Ord. | 87½—92½b | .. | .. |
| 79,185 | 1 | Apl. 22 | †2/- | †2/- | Colombo Ltd. Ord. | 28/—30/- | .. | .. |
| 24,495 | 1 | ,, | 1/4⅜ | 1/4⅜ | Do. 7 p.c. Pref. | 20/—22/- | .. | .. |
| 1,518,280 | Stk. | Mar. 4 | 5½ | 5½ | Commercial 4 p.c. Cap. | 78—81 | +1 | 78—79 |
| 560,000 | ,, | ,, | 5/8/4 | 5/8/4 | Do. 3½ p.c. Cap. | 77—80 | +1 | .. |
| 475,000 | ,, | June 24 | 3 | 3 | Do 3 p.c. Deb. | 54—57* | −1 | 55—56 |
| 800,000 | ,, | Oct. 8 | — | 4 | Continental Union, Ltd. | 26—31 | .. | .. |
| 200,000 | ,, | Mar. 4 | 7 | 7 | Do. 7 p.c. Pref. | 85—88 | .. | 87 |
| 737,150 | ,, | Mar. 4 | 6½ | 6½ | Croydon sliding scale | 95—98 | .. | .. |
| 403,100 | ,, | ,, | 5 | 5 | Do. max. div. | 79—82 | .. | .. |
| 492,270 | ,, | Mar. 4 | 6 | 9 | Derby Con. | 107—109c | .. | .. |
| 55,000 | ,, | Dec. 17 | 4 | 4 | Do. Deb. | 74—76c | .. | .. |
| 209,000 | ,, | Mar. 4 | 5 | 5 | East Hull Ord. 5 p.c. | 86—89 | .. | .. |
| 50,000 | ,, | June 24 | — | 5 | Eastbourne 5 p.c. Deb. | 91—96* | −2 | .. |
| 1,002,180 | 10 | Apl. 1 | †6 | †4 | European, Ltd. | 5—6 | .. | 5—5½ |
| 18,788,960 | Stk. | Feb. 18 | 5½ | 4/17/4 | Gas Light & Coke 4 p.c. Ord. | 85—87 | +1 | 85—87 |
| 2,600,000 | ,, | ,, | 3½ | 3½ | Do. 3½ p.c. max. | 58—61 | .. | 58⅝—59⅜ |
| 4,157,020 | ,, | ,, | 4 | 4 | Do. 4 p.c. Con. Pref. | 76—79 | .. | 77—77⅜ |
| 5,602,620 | ,, | June 24 | 3 | 3 | Do. 3 p.c. Con. Deb. | 56—59* | −1 | 58⅛—59 |
| 181,315 | ,, | ,, | — | — | Do. 6 p.c. Br'tf'd Rd. Db. | 100—105* | −½ | .. |
| 130,000 | ,, | — | 10 | 10 | Do. 10 p.c. Bonds. | .. | .. | .. |
| 42,000 | ,, | — | 7½ | 7½ | Do. 7½ p.c. Ilford Deb. | .. | .. | .. |
| 82,500 | ,, | Mar. 18 | 6⅔ | 6⅔ | Hastings & St L. 5 p.c. Conv | 88—93 | .. | .. |
| 258,740 | ,, | ,, | 5½ | 5½ | Do. 3½ p.c. Conv. | 68—73 | .. | 70 |
| 70,000 | 10 | June 10 | †10 | †10 | Hongkong & China, Ltd. | 19½—20½ | .. | .. |
| 173,200 | Stk. | Mar. 4 | 10 | 10 | Hornsey Con. 3½ p.c. | 66—68 | .. | .. |
| 1,976,000 | ,, | May 20 | 10 | ‡10 | Imperial Continental Cap. | 123—128 | .. | 123¾—126 |
| 226,170 | ,, | Feb. 4 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. | 69—72 | .. | .. |
| 235,242 | ,, | Mar. 18 | 6½ | 6½ | Lea Bridge 5 p.c. Ord. | 95—100 | .. | .. |
| 2,127,340 | ,, | Feb. 18 | 5½ | 5½ | Liverpool 5 p.c. Ord. | 80—81b | +½ | .. |
| 600,000 | ,, | Mar 18 | 7 | 7 | Do. 7 p.c. Red. Pref. | 101½—103½b | .. | .. |
| 165,736 | ,, | Feb. 12 | 9 | 8 | Maidstone 5 p.c. Cap. | 115—120 | .. | .. |
| 63,480 | ,, | June 24 | 3 | 3 | Do. 3 p.c. Deb. | 53—58* | −1 | .. |
| 75,000 | 5 | June 24 | 6 | †7 | Malta & Mediterranean | 5—5½* | +½ | .. |
| 541,920 | Stk. | May 20 | †4 | †6 | Montevideo, Ltd. | 75—78 | .. | .. |
| 2,061,315 | ,, | Mar. 4 | 5 | 5 | Newcastle & Gateshead Con. | 69½—70½d | −1 | .. |
| 360,929 | ,, | ,, | 4 | 4 | Do. 4 p.c. Pref. | 75—76d | .. | .. |
| 529,705 | ,, | June 24 | 3½ | 3½ | Do. 3½ p.c. Deb. | 68—70d* | −1 | .. |
| 15,000 | ,, | Mar. 4 | 11½ | 11½ | North Middlesex 10 p.c. | 155—160 | .. | .. |
| 91,530 | ,, | ,, | 8⅚ | 8⅚ | Do. 7 p.c. | 112—117 | .. | .. |
| 300,000 | Stk. | May 6 | 9 | 7 | Oriental, Ltd. | 96—101 | +1 | 100—100½ |
| 188,120 | ,, | June 24 | 7⅞ | 7⅞ | Plym'th & Ston'house 5 p.c. | 108—113* | −2 | .. |
| 60,000 | 50 | Mar. 4 | 14 | 14 | Portsea Island B | 90—95 | .. | .. |
| 100,000 | 50 | ,, | 13 | 13 | Do. C | 88—93 | .. | .. |
| 2,289,909 | 1 | — | — | — | Primitiva Ord. | 9/9—10/9 | .. | 9/6—10/1½ |
| 282,200 | 100 | June 1 | 4 | 4 | Do. 4 p.c. Red. Deb. | 83—85 | .. | 85 |
| 600,000 | Stk. | Jan. 21 | 4 | 4 | Do. 4 p.c. Red. Deb. 1911 | 66—68 | .. | .. |
| 180,305 | ,, | June 24 | 4 | 4 | Do. B. Aires 4 p.c. Rd. Db. | 65—67* | −1 | .. |
| 256,847 | ,, | ,, | 4 | 4 | Do. R'r P'te 4 p.c. Rd. Db. | 65—67* | −1 | .. |
| 150,000 | 10 | Mar. 18 | 6 | 6 | San Paulo 6 p.c. Pref. | 7⅛—8 | .. | 7⅞ |
| 125,000 | 50 | Jan. 4 | 5 | 5 | Do. 5 p.c. Red. Deb. | 43—46 | .. | 45 |
| 270,000 | Stk. | Mar. 18 | 5½ | 6 | Sheffield A | 98—100c | .. | .. |
| 419,968 | ,, | ,, | 5½ | 6 | Do. B | 98—100c | .. | .. |
| 1,047,000 | ,, | ,, | 5½ | 6 | Do. C | 98—100c | .. | .. |
| 90,000 | 10 | June 11 | 4 | — | South African | 5—7 | .. | .. |
| 6,609,895 | Stk. | Mar. 4 | 5 | 7 | South Met. Ord. | 93—95 | .. | 93½—94½ |
| 1,895,445 | ,, | Jan. 7 | 3 | 3 | Do. 3 p.c. Deb. | 56—59 | .. | .. |
| 734,000 | ,, | Mar. 4 | 6½ | 6½ | Do. 6½ p.c. Red. Db. | 102—104 | .. | 102½ |
| 91,500 | ,, | Mar. 4 | 8½ | 8½ | South Shields Con. | 117—119d | .. | .. |
| 1,187,795 | ,, | Mar. 4 | 6½ | 6½ | South Suburban Ord. 5 p.c. | 98—101 | .. | .. |
| 368,837 | ,, | June 24 | 5 | 5 | Do. 5 p.c. Deb. | 92 95* | −2 | 96⅜ |
| 647,740 | ,, | Mar. 18 | 5 | 5 | South'mpton Ord. 5 p.c. max. | 77—80 | .. | 79—79⅜ |
| 121,375 | ,, | June 24 | 4 | 4 | Do. 4 p.c. Deb. | 68—73* | −1 | .. |
| 250,000 | ,, | Mar. 4 | 7 | 7 | Swansea 7 p.c. Red. Pref. | 99—102 | .. | .. |
| 200,000 | ,, | June 24 | 6½ | 6½ | Do. 6½ p.c. Red. Deb. | 99—101* | −1 | .. |
| 120,000 | ,, | Feb. 18 | 7⅛ | 7⅛ | Tottenham District A 5 p.c. | 108—113 | .. | .. |
| 882,275 | ,, | ,, | 5⅞ | 5⅞ | Do. B 3½ p.c. | 88—91 | .. | .. |
| 150,000 | ,, | ,, | 28/4 | 5½ | Do. 5½ p.c. Pref. | 101—103 | .. | .. |
| 181,355 | ,, | June 10 | 4 | 4 | Do. 4 p.c. Deb. | 73—76 | .. | .. |
| 258,251 | ,, | Mar. 18 | 5 | 5 | Tynemouth Con. and New Uxbridge, Maidenhead, & | 67—68d | .. | .. |
| 197,294 | ,, | Mar. 4 | 6⅝ | 6⅝ | Wycombe 5 p.c. | 90—95 | .. | .. |
| 88,330 | ,, | ,, | 5 | 5 | Do. 5 p.c. pref. | 85—90 | .. | .. |
| 91,800 | ,, | ,, | 6⅝ | 6⅝ | Do. 5 p.c. Maidenh'd | 87—92 | .. | .. |
| 30,000 | ,, | Mar. 4 | 8½ | 8½ | Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. | 123—128 | .. | .. |
| 255,636 | ,, | ,, | 7 | 7 | Do. B 3½ p.c. | 103—108 | .. | .. |
| 412,450 | ,, | ,, | 5/19/0 | 5/19/0 | Do. C and New | 88—93 | .. | .. |
| 352,000 | ,, | ,, | 6⅝ | 6⅝ | Wimbledon 5 p.c. | 98—103 | .. | 102¾ |
| 98,000 | ,, | ,, | 7½ | 7½ | Epsom 5 p.c. | 105—110 | .. | .. |
| 88,416 | ,, | June 24 | 3 | 3 | 3 p.c. Deb. | 54—57* | −1 | .. |

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TAR.

**THE Gas Committee of the above** Council are prepared to consider TENDERS for the Purchase of the SURPLUS TAR produced at their Works during Twelve Months ending June 30, 1927.
Tenders, endorsed "Tender for Tar," must be delivered to Mr. Geo. Wainwright, Clerk, Town Hall, Penrith, not later than noon on Monday, July 5, 1926.
The Committee do not bind themselves to accept the highest or any Tender.
Further particulars may be obtained from
E. SHAUL,
Manager.
Gas-Works,
Penrith,
June 24, 1926.

### LOUGHBOROUGH CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

**THE Gas Committee of the Lough-** borough Corporation invite TENDERS for the Purchase of the SURPLUS TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months from the 1st of July, 1926, to the 30th of June, 1927.
Estimated amount of Tar, 600 Tons; Liquor, 1200 Tons.
The Contractor to state price for Liquor at 5° Twaddel and per ton extra for every ½° above 5°.
The Corporation to deliver both Tar and Liquor either into Contractors' Boats at Canal Wharf or into Contractors' Tanks at the L.M. & S. Nottingham Road Station, L.M. & S. Derby Road Station, or L. & N.E. Station, Loughborough.
Tenders to be endorsed, "Tenders for Tar and Liquor," and addressed and delivered to H. Perkins, Esq., Town Clerk, Town Hall, Loughborough, not later than Monday, the 12th of July next.
The Committee do not bind themselves to accept the highest or any Tender.
EDWARD ONIONS,
Engineer and Manager.
Loughborough,
June 25, 1926.

### CITY OF STOKE-ON-TRENT.
(GAS DEPARTMENT.)

GAS CONSOLIDATION ACT, 1922.

CONTRACT No. 97.

**THE Gas Committee invite Tenders** for a CONTINUOUS VERTICAL RETORT INSTALLATION, together with Coal and Coke Handling Plant, &c., at Etruria Gas-Works.
Persons desirous of tendering are requested to make written Application to the Chief Gas Engineer, Gas-Works, Etruria, Stoke-on-Trent, not later than Saturday, the 24th of July, and to enclose Deposit of £1 Treasury Note, which will be returned on receipt of a *bona-fide* Tender and the Return of all Plans and Documents, and also provided Tenders are received by the date mentioned.
Sealed Tenders to be forwarded to the undersigned not later than Twelve noon on Wednesday, the 1st of September, and endorsed Tender for "Vertical Retorts, &c., Gas Department."
E. B. SHARPLEY,
Town Clerk.
Town Hall,
Stoke-on-Trent,
June 28, 1926.

## COMPANY NOTICES.

### COMMERCIAL GAS COMPANY.

**NOTICE is Hereby Given that the** TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO CAPITAL STOCKS, WILL BE CLOSED from the 5th of July to the 4th of August, both days inclusive.
By order of the Board,
F. J. BRADFIELD,
General Manager and Secretary.
Offices, Stepney, E. 1,
June 24, 1926.

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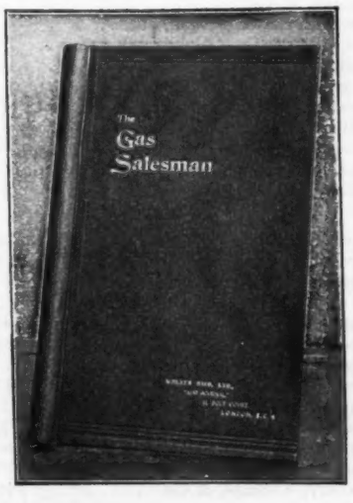


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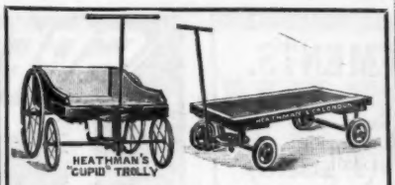

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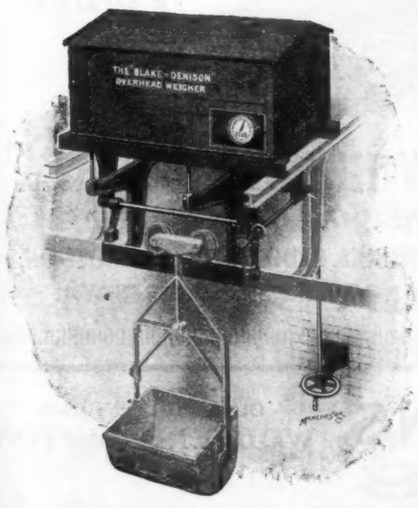

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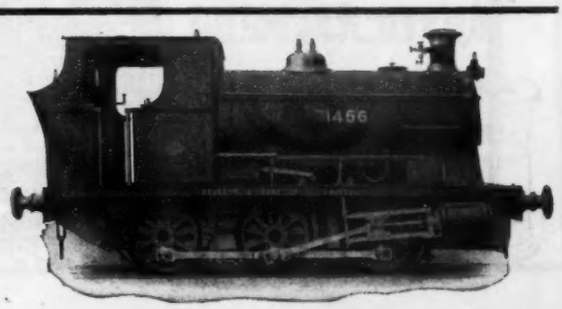

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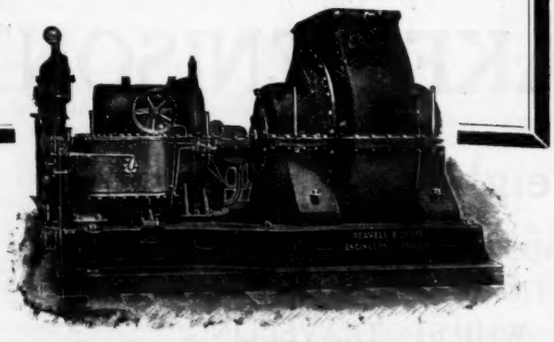

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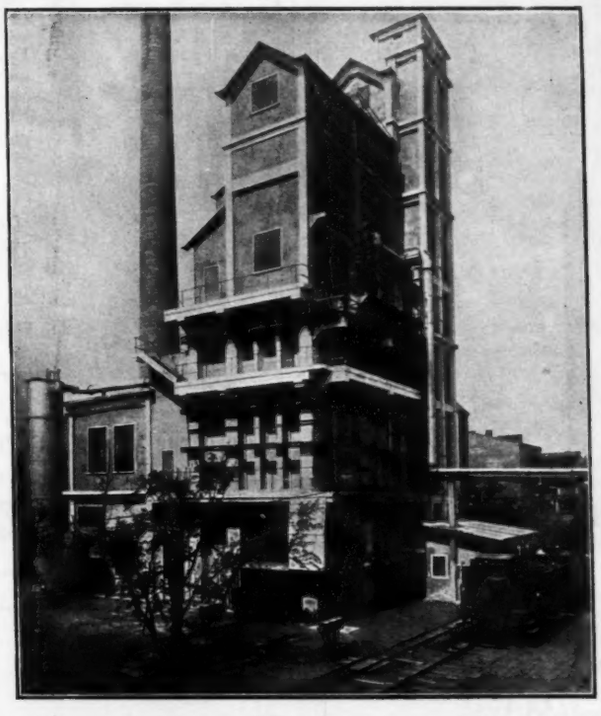

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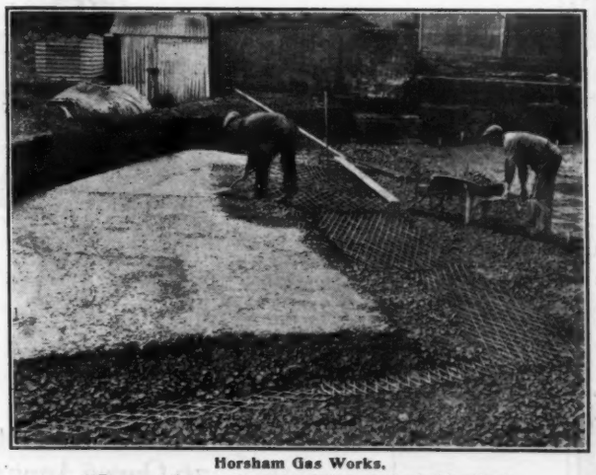

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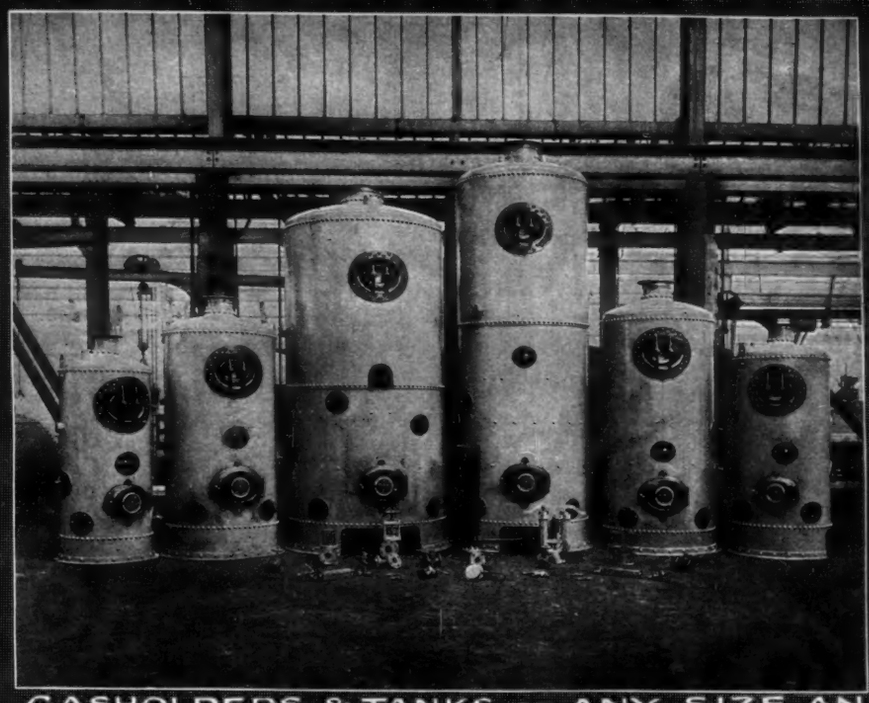

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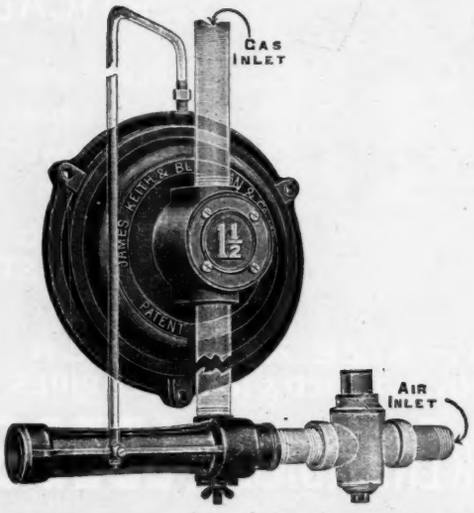


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